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Tests of Superheater Locomotives

The appendix to the report of the Committee on Superheater Locomotives, presented at the last Master Mechanics' convention, which, it was mentioned on page 1373 of the June 14 issue of the *Daily Railway Age Gazette*, would be reproduced in the regular weekly and mechanical editions, is so voluminous and important that no effort has been made to include any of it in this edition. In later issues the various sections of this report will be considered at some length and presented in a form which will make them readily available for the use of our readers.

Unwise Economy in the Drafting Room

The importance of considering all allied departments when making changes of any kind in any department of a railroad, is well illustrated by a recent example of some improvements in drawing room practice. It was decided at one large drafting room that considerable saving could be made if the practice of making drawings to scale was abandoned. It is quite possible that the expected result was accomplished. The effect on the shop, however, will be readily appreciated by examining the illustrations given by Mr. Morrison in his article in this issue. The dollars lost by a workman trying to make something of these drawings will be easily imagined. It is a very excellent thing to try, in every way, to save as much money as possible in the drafting room, but only when it is known beyond doubt that this will not directly result in a loss of far more in some other department.

Heat Treatment of Case-Hardened Steel

There is no doubt but what a better knowledge of the effect of proper heat treatment of case-hardened steel would be of considerable value in most railroad shops. The success or failure of these parts in service is almost entirely dependent on the method of handling after they leave the case-hardening furnace. At the recent convention of the American Society for Testing Materials, a committee proposed for adoption a recommended practice for the heat treatment of case-hardened carbon steel objects, in which the proper method of handling to obtain different desired results is very concisely and accurately set forth. There were four different conditions selected for discussion, starting with the hardest surface and the least strength, and following through four variations to the greatest strength with the least hardness.

Where the hardness of the case only is required and lack of toughness, or even brittleness, is unimportant, the articles may be quenched by emptying the contents of the case-hardening

boxes directly into cold water or oil. In this way both the core and the case are very coarsely crystalized and of course the strength is very low. If the articles are allowed to cool to a temperature slightly exceeding the critical range of the case-hardening, usually from 800 deg. to 825 deg. C., (1472 deg. to 1517 deg. F.) and then quenched, the core and case still remain crystaline, but the danger of distortion or cracking in the quenching bath is reduced and the strength is somewhat increased. The next recommended method is to give a result which will increase the toughness and strength of the article and refine the case, and for this the articles are allowed to cool slowly in the carbonizing pot to a temperature of about 650 deg. C. (1200 deg. F.), are then reheated to a temperature slightly exceeding the lower critical point of the case, which in most cases will be 775 deg. to 825 deg. C. (1427 deg. to 1517 deg. F.) and are then quenched in water or oil. They should be removed from the quenching bath before their temperature has fallen below 100 deg. C. (212 deg. F.). By allowing them to cool slowly to a temperature of about 650 deg. C. (1200 deg. F.) and then reheating to a temperature of about 900 deg. to 950 deg. C. (1652 deg. to 1740 deg. F.), followed by quenching in oil, from which they are removed before they have dropped below a temperature of 100 deg. C. (212 deg. F.) then reheating to about 800 deg. C. (1652 deg. F.) and again quenching in water or oil, both the case and the core will be thoroughly refined and their toughness greatly increased.

The report also points out that in order to reduce the hardening stress created by quenching, the objects, as a final treatment, may be tempered by reheating them to a temperature not exceeding 200 deg. C. (392 deg. F.). A more thorough understanding of these critical temperatures and the proper way of handling them by shop foremen is a matter which the various foremen's associations would do well to consider.

Training Apprentices

Initiative, self-reliance and resourcefulness are qualities which are usually best developed by necessity. Furthermore, they are among the most important and valuable qualities that a successful railroad man can possess. It was recently pointed out by a motive power official that the general practice of training apprentices, and more particularly special apprentices, or those who have graduated from a university, in the large shops of the system, while of great value in teaching the best practice and methods, has a decided tendency in reducing their effectiveness in the case of emergency, and makes them practically helpless when complete facilities are not immediately at hand. To overcome this it is suggested that, as part of their course, the apprentices be required to spend some time at an outlying point where the facilities are extremely meager. It is believed that experience of this kind will greatly strengthen their resourcefulness and self-reliance.

Car Construction

The report of the special committee on car construction made at the convention of the Master Car Builders' Association is to be referred to letter ballot for adoption as recommended practice. It is one of the most important that was presented before the convention and if adopted, and fully followed, will have a far reaching effect on the cost of car maintenance. It requires that, for new cars, the area of center sills shall not be less than 24 sq. in., and that the ratio of stress to end strain shall not be more than .06. It further recommends that existing steel or steel underframe cars which have less than 16 sq. in. area of center sills and a ratio of stress to end strain of more than .09, shall be classified with wooden cars and be subject to the same rules for combination defects. The recommendations further require that the length of center or draft sill members, or part of a member between braces, is not to be more than twenty times the depth of the member measured in the direction in which buckling might take place.

Where the proper distribution of the metal is made in connection with this area requirement, there is little doubt but what these requirements will force the building of equipment which will not develop weakness under the most severe conditions of ordinary service. The earlier steel cars are now generally admitted to have been too light, but on the other hand, traffic conditions during the past ten years are found to have increased the stress to cars due to end shock by at least 50 per cent. If these conditions continue to become more severe in the same ratio, ten years from now cars of a strength recommended by this committee will be as much too weak as the earlier steel cars are at the present time. It is, however, neither possible nor advisable to build present day cars for unknown future requirements, but there is no doubt but what all cars now being built should at least fully meet the most difficult conditions now existing. If the recommendations of this committee are adopted it is not at all improbable that they will have to be increased within the next five years.

Next to the underframe requirement, the recommendations of the committee in regard to box car ends are of the greatest importance. After careful consideration it was decided that either all-steel or heavily wooden reinforced ends are the only construction that will meet the requirements satisfactorily. It is recommended that for cars with wooden ends, a reinforcement consisting of a 3/16 in. steel plate extending for the full width of the end and for about two-thirds of the height, be installed beneath the lining, and further, that there be applied two pressed steel horizontal braces reaching around the corners and being well secured to the side frames. When complete new ends are required in wooden superstructure cars, it is recommended that the all-steel end be used and the committee submitted recommended designs for both cases. Cars with ends of the type recommended are known to be capable of withstanding the effects of the heavy shifting load in the hump yard, which, experience has shown, practically any design of all wood end will not do. In view of this it is difficult to conceive of the association refusing to adopt the report of this committee as recommended practice.

Subjects for Master Mechanics' Association

In a review of the work of the American Railway Master Mechanics' Association at its convention last month, the address of President D. F. Crawford should occupy a prominent position. It has been too frequently the custom in the past to applaud and commend the suggestions made in the president's address for the future work and the improvement of the association, and then promptly proceed to overlook them in the preparation of the next year's program. It is to be sincerely hoped that that will not prove to be the case this year, for the advice and recommendations made by Mr. Crawford are of vital importance if the association is to continue to occupy the place and standing it deserves.

It is pointed out by Mr. Crawford that too much attention has been devoted in the past to material and consideration of the locomotive as a mechanical device rather than as an instrument of transportation. The study of the general proportions, the hauling capacity, the adaptability of the machine to specific work, the obtaining of a maximum output with minimum expense is of far more importance to the railways and to the public than the study of the smaller details of the machine, and the minute variations in the composition of the materials used in its construction. The full realization of this fact must come to the members of the Master Mechanics' Association or their field will be pre-empted by some other body. Criticism has been heard that the American Society of Mechanical Engineers has organized a Railway Session and is undertaking work which logically should come before the Master Mechanics' Association. The fact remains, however, that the Master Me-

chanics' Association has not undertaken this work in the past and its members certainly have no ground for objections to another nationally organized body undertaking it. It is very largely left to this association to decide for itself what work it cares to undertake and if it is not considered advisable to consider the larger problems of design and operation in the thorough, serious manner they deserve, wherein lies a cause for criticism of another society for doing it?

Mr. Crawford made but three definite suggestions for future subjects, and gave very convincing reasons why these should be undertaken immediately. One was the determination of a train resistance formula of sufficient accuracy to be of practical application and value and take the place of the thirty or forty formulas that now are in more or less general use. The single instance mentioned where one of the most generally accepted and frequently used formulas gave a drawbar pull which was over twice the actual amount as shown by the dynamometer car, is sufficient to show the importance of this matter.

The determination of an accurate method of indicating the hauling capacity of locomotives and train loading that would be suitable for all kinds of locomotives under the various conditions of service was the second subject suggested. While more activity has been shown by the association on this subject than on the other and the data available is much more reliable and practical, still it behooves the Master Mechanics' Association to keep strictly in the forefront and occupy the place as an authority on the subject which, by virtue of the quality of its membership, it should hold.

As a third suggestion, Mr. Crawford points out that some more logical unit than lading or gross ton-miles should be considered for making comparison of operating costs and the performance of equipment and he suggests that a committee be appointed to devise such forms for statistics as would meet the requirements of the railways and others interested in their application. In these days of increasing government activities along the lines of railway regulation, reliable statistics of the cost of operation and of the maintenance of equipment are of the greatest importance and value. To whom should we look for the determination of the proper basis of comparison of locomotive costs if not to the American Railway Master Mechanics' Association?

Steam Consumption from Indicator Cards

Some remarkably interesting information has been developed by J. Hall Clayton, assistant in the mechanical engineering department, Engineering Experiment Station of the University of Illinois, in connection with the development of a method whereby the steam consumption of a locomotive can be accurately obtained directly from the indicator cards. The amount of steam consumed for each indicated horse power is the measure of success of the design of any steam engine, and is of particular importance on a locomotive where the steam making capacity is the controlling factor of the power. While by far the largest number of locomotive tests are made while the machine is in operation on the road, and in each case the amount of steam required for each horse power per hour is carefully figured on the basis of the amount of water evaporated, with corrections for that used by the auxiliaries and wasted through the safety valves, it is known that there are indeterminable errors always entering in the problem and that the result is, at the best, but a fair approximation.

It has heretofore been considered impossible to obtain a reliable estimate of the steam consumption from the indicator diagram because of the lack of knowledge as to the amount of initial condensation of the steam up to the point of cut-off, and the amount of the piston or valve leakage, as well as the great difficulty in correctly locating the events of the cycle on the diagram, particularly those taken at high speeds. Tests made on a testing plant are of course subject to control in every particular and the amount of steam for each indicated horse power can be obtained with accuracy. Mr. Clayton checks his method of analysis by applying it to indicator cards made on a testing plant and, in every case, obtained a result that varied from the actual figures but by a very small percentage. In addition to obtaining the amount of steam consumption, this method of analysis permits the discovery of leakage into or out of cylinders while the engine is in normal operation and also allows the amount of clearance displacement to be found as well as an accurate determination of the location of the event of the cycle. The development of these methods in detail is described in Bulletin No. 58, and their application to indicator diagrams of locomotives in Bulletin No. 65 of the Engineering Experiment Station of the University of Illinois.

The method developed consists of transferring the indicator diagrams to logarithmetic cross section paper. When the diagrams are plotted in this way, it is found that the expansion and compression lines closely approximate a straight line, and it is possible to ascertain the value of the power to which the product of the pressure and the volume is raised to equal a constant, *i. e.*, the value of n in the formula, $P V^n = C$. It has been discovered that the value of this power is controlled largely by the quality of the mixture which is present in the cylinder at the point of cut-off and that the relation of this quality, and the power is practically independent of the cylinder size and of the engine speed for the same class of locomotive or other steam engine. This enables the determination of the actual amount of steam and water present in the cylinder at the point of cut-off, and thus gives, from the diagram, the actual steam consumed.

It has been found that by the use of this method in connection with road tests, it will be possible to obtain reliable information as to the amount of steam used by auxiliaries and the amount wasted. Furthermore, the existence, and in some cases the amount of leakage, due to leaky valves into or out of the cylinders, may be ascertained. The amount of spring in the valve gears is shown in the logarithmetic diagrams by the change in location of the cyclic events under various conditions. The amount of clearance may also be found from the diagram with a fair degree of accuracy at the same time.

The development of this new method by Mr. Clayton will greatly increase the value and importance of locomotive road tests and permit the obtaining of reliable data which it has heretofore been considered was impossible except by the use of an expensive locomotive testing plant. Greater refinement in valve gear and cylinder design is needed on American locomotives, and it is possible that the use of this method may make the shortcomings so prominent that energetic steps will be promptly taken to correct them.

NEW BOOKS

Resuscitation. By Dr. Chas. A. Lauffer, Medical Director, Westinghouse Electric & Manufacturing Company. Bound in cloth. 47 pages, 4 in. x 6½ in. Illustrated. Published by John Wiley & Sons, New York. Price 50 cents.

This book includes a reprint of a paper on this subject delivered by the author before the Philadelphia section of the National Electric Light Association. After explaining a number of successful results which have been obtained by employing resuscitation methods on men who were supposedly dead, the book gives a clear description of the mechanism of respiration, illustrating it by a number of views of the various parts of the anatomy. The prone pressure or Schafer method of resuscitation, which has been adopted by the National Electric Light Association, and a number of other engineering societies, is described in detail. It brings out in a clear, concise manner the necessity of people in general being versed in the principles of resuscitation, and clearly shows how they can be learned so as to prove valuable to persons in ordinary walks of life.

COMMUNICATIONS

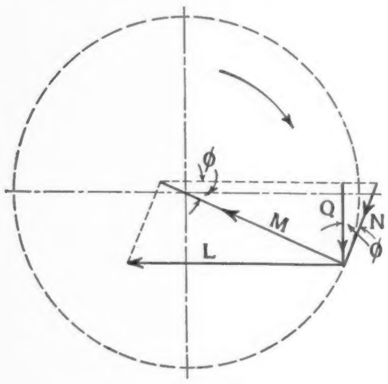
TRUCK EQUALIZER DESIGN

St. Charles, Mo., May 29, 1913.

To the Editor:

On page 96 of the February, 1913, issue of the American Engineer, there appeared an article entitled "Truck Equalizer Design," by L. V. Curran. In studying over this article carefully, I find that Mr. Curran has overlooked a very important force that should enter in the computation. This is the vertical component of the pull on the brake shoe and is greater than the frictional force included in the formulas given.

Referring to the diagram the forces there shown are as follows:



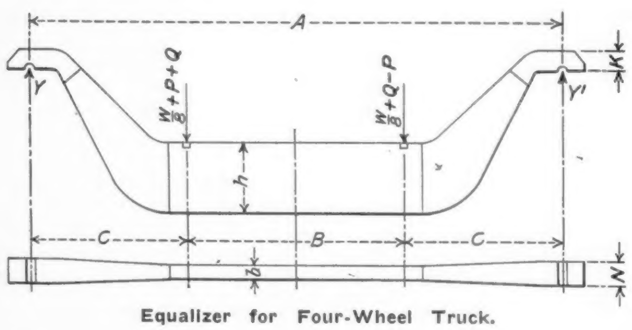
L = Horizontal pull on the brake shoe.
M = Radial component of L.
N = Tangential component of L.
Q = Vertical component of N.

Disregarding the friction for the moment, it is seen that there is a radial force and a tangential force resulting from the horizontal pull on the brake shoe. The radial force, $M = L \cos \phi$. The tangential force $N = L \sin \phi$. The vertical component of $N = Q = N \cos \phi$. Substituting for N we have $Q = L \sin \phi \times \cos \phi$. This is the force that has been omitted by Mr. Curran.

For the frictional force between the shoe and the wheel, the formula given by Mr. Curran is correct; this is $P = fL \cos^2 \phi$.

In designing an equalizer we should therefore deal with $P + Q$ instead of P only.

I think the coefficient of friction, 0.25, as given by Mr. Curran is somewhat too high. In the Master Car Builders' Proceedings of 1910, the report of the tests on the Lake Shore & Michigan Southern during 1909 showed a coefficient of friction of 0.10, which I believe is the better figure to use.



Equalizer for Four-Wheel Truck.

Referring to the illustration of an equalizer for a four-wheel truck and using the same notation as in Fig. 2 in Mr. Curran's article, we have the load on the two springs

$$\frac{W}{8} + P + Q \quad \text{and} \quad \frac{W}{8} + Q - P$$

and the reaction at Y:

$$Y = \left(\frac{W}{8} + P + Q\right)\left(\frac{B + C}{A}\right) + \left(\frac{W}{8} + Q - P\right)\left(\frac{C}{A}\right)$$

$$Y = \frac{BW + 8PB + 8QB = 2CW + 16CQ}{8A}$$

If $P + Q = K$

$$Y = \frac{AW + 8BK + 16CQ}{8A}$$

The maximum bending moment will therefore be

$$M = C. \quad Y = \frac{C\,(AW + 8BK + 16CQ)}{8A}$$

The force Q will also enter in the calculations of the equalizer for a six-wheel truck.

Sigurd Holm,
American Car & Foundry Company.

CARE OF SUPERHEATER TUBES.

St. Louis, Mo., May 31, 1913.

To the Editor:

It is to be regretted that more time could not be allowed for the discussion of the care of superheater tubes at the recent convention of the Master Boilermakers' Association. Because of the heavy rush of business it was almost impossible to get the floor to bring out questions, which, in my opinion, would be beneficial to all master boilermakers. I therefore wish to describe the methods we use in the care of the large 4½-inch tubes in the superheater engines on the Missouri Pacific Lines. We have experienced some trouble with the large tubes leaking, and while it is contrary to the instructions of our superintendent of machinery for the boilermakers to use the flue rollers, in some cases those instructions have been disregarded and the flue rollers have been used to such an extent that some of the large tubes have been rolled until they are from ¼ in. to 5/16 in. larger in diameter than the original size. I happened to be at a certain point on the system when one of the large passenger engines had an engine failure due to the 4½-in. tubes leaking. On making an inspection of the firebox and tubes I found that the expanders that were intended to be used on this class of work were entirely too small because of the heavy rolling that the tubes had had. In applying the rollers in the large tubes it was found that they would not make the flues tight as the flues had become hard from the constant rolling. To overcome this I made a casing of scrap tank steel, rolled it around the seam of rivets of the flanges on the flue sheet and packed magnesia lagging between this casing and the rivet heads. The large flues as well as the small ones were then plugged up with magnesia, which was pushed back into the flue about 4 or 5 in. A plate of ¼-in. scrap tank steel, 12 in. wide, was placed across the face of the tube sheet, two rows of flues below the large flues, a couple of bolts on each side being used to hold it. We then bent a piece of our standard netting around the edge of this plate, forming a basket, which was filled with charcoal. A fire was started in this charcoal and in about two hours' time the flues all became a cherry red. The expansion forced all of the tubes into the firebox about 1/16 in. This annealed the tubes so that they could be expanded and beaded satisfactorily. The engine was put in service and has been running constantly for the past 60 days without giving any further trouble. We have had such good results from this engine that we have adopted this practice on the system.

T. P. Madden.
General Traveling Boiler Inspector.

Transportation in Madras.—It is suggested that the needs of better transportation facilities in the Madras presidency might be met, in the absence of railway extensions, by putting industrial motors on the roads. A Madras correspondent of an Indian contemporary remarks that the leap from railways to motor traffic is easy and that the increased utilization of road traction would be justifiable, if only from the point of view of not putting all your traffic eggs in one basket. The demand for more ample traveling and freight car facilities forms one of the principal themes at the meetings of the District Boards. It is constantly coming under the consideration of trades people and of their Chambers of Commerce. The need is universal and insistent.

YOU HAVE RECEIVED, WHAT WILL YOU GIVE?

Address Made at the Commencement Exercises of the Casino Technical Night School, East Pittsburgh.*

BY G. M. BASFORD.

If I am able to place clearly before you a thought that is in my mind, perhaps my presence here may be not in vain. This thought centers in what the present moment means to me. Perhaps I may make it mean a little more to you.

Some years ago it fell to the lot of the speaker to work in a railroad machine shop beside a boy who was mis-called an apprentice. What was his name? What has become of him? He went into the stream of working humanity. He is one of the mass to whom hopeless ambitionless toil has become second nature and for whom life holds little joy and no sunshine. His intelligent inquiry about his work was met by a gruff answer, or rather a refusal to answer. He was taught nothing, but was allowed to find his own niche, the one easiest for him to crawl into. He found it, and in it he remained.

At that time the speaker had a vision. He dreamed of an apprenticeship, real apprenticeship with trade training, educational in itself and co-ordinated with technical school opportunities which would reveal to the mind the reasons for the work of the hands. A dozen years passed and right in this spot this dream became a reality. I do not believe a member of this community, not even the presiding officers of these great manufacturing organizations and those who are responsible for the development of this school are able to realize what this means as I do. I do not believe even the unselfish, self-forgetful, devoted instructors of this school appreciate this moment as I do.

It is impossible to forget the searching inquiry, the painstaking study of the needs of those for whom the school was founded and the careful planning that preceded its inauguration. Following this was the plunge into the school enterprise itself. You who receive your parchments this evening can know little of this, or of what it meant to those who started this work. You perhaps do not know how some of your devoted instructors kept the school going in times when there was no money for the school or for their salaries. They worked for their ideal, for your good, for your happiness. If they had not done so you would not be here tonight. All honor to them for this devotion. If you have acquired even a small portion of the spirit that inspired them you will devote your lives to lending the helping hand to others who need it. You cannot justify your presence here this evening if you do not do this. You can not repay your teachers in any other way.

In years to come you will remember this school. If you have learned its lesson you will understand what education means. You will find within yourselves resources, resources to enable you to find your niche in life and to enable you to fill it. If you have the spirit of this school you will be the better worker because a thoughtful worker. You are not educated unless you can think. Your diploma is of no value if it marks merely the completion of a course, if it means merely that you are an expert passer of examinations. It is of greater value if it shows that you have thought your way through four years. It is quite possible to complete a college course of four years and acquire a degree without learning to think. I know, for I did this very thing. It would be impossible for you to spend four years here without learning to reason.

If you have done your part in the past four years you are already educated young men, not men with education. There is a vast difference between the two. The first is like the development of a beautiful flower; the second is like the filling of a glass from a pitcher. The beautiful flower grows, develops from the bud. It develops from within, it opens its petals, unfolds. Real education is like this, but bear in mind that this school is only the beginning of your education and that the methods of this course are to be followed all through life, if you are to make the most of this wonderful opportunity.

Perhaps some of you may think that you would prize the diploma from a college more than you will prize that which you are to receive tonight. Without under-estimating in any way the value of the college parchment, I believe that should any of you later on pursue your studies and attain the college degree, you will look upon the award of this evening as of the greater value. You are perhaps more fortunate than you know, to have the opportunity which this school has given you. In many respects it offers advantages which the college does not. In case you do not appreciate this fact, and in order to be sure that you understand the value of the methods here employed, let me tell you what it means to me.

In coming here you knew what you wanted. Many college students do not have this advantage. Then your teachers knew what you wanted, whereas many college professors do not know what their students want and do not understand the life into which their graduates go. Your teachers are men who are actually holding their own in the strenuous game of life. They are not men who are merely teaching subjects for the sake of those subjects themselves. For example, your teachers do not present to you so-called pure science or pure mathematics, or pure anything else, pure in the sense of being entirely removed from practical application. Your instructors have presented science in a way possible of direct application to the problems of your lives. Your instructors know how to educate, because they know how to do. They are doing. Furthermore you are working while studying and studying while working, your studies being an interpretation of the meaning of the things you do in your work.

Note the fact that you are members of a working organization fitting yourselves the better for higher places in that organization. You are not removed for four long years from actual contact with life and placed for that long period in artificial surroundings, depending upon someone else to pay your bills. You are doing work that counts, that helps you today and will help you later on. Those who work their way through college can't always do that. Education always means more to one who pays his own way while securing it, because the responsibilities of life are constantly in mind. It is not necessary for you to find your life work after graduation, for you are already in your life work. How many of our college graduates are stranded in the world after four years of their artificial life, with no definite idea of what they are fitted for and what they want to do. Think a moment of the advantages you have over them.

On the other hand, your study here has been narrow—it could not be otherwise. All technical schools are necessarily narrow. You have not had time for something that the college student acquires and that you must have. I mean culture of the mind, development of good taste in literature, history, art or music. I mean mental resources and inspirations which will prepare you to be interesting companions, which will enable

*The Casino Technical Night School at East Pittsburgh, Pa., is supported by the Westinghouse interests, but is open to any member of the community. Tuition is free. It has an engineering department with thirteen instructors in charge of the following subjects: Electricity, steam, chemistry, English, physics, machine shop, foundry, pattern shop, mechanical drawing, mathematics, preparatory, foreign and health. There is also a woman's department having five instructors in charge of cooking, sewing, music, commercial and preparatory work. The president of the school is C. R. Dooley, who is also in charge of the educational work of the Westinghouse Electric & Manufacturing Company.

you to interpret and discuss progress of the times, and will put you in position to grow in every other way as you have grown in knowledge of your work. A man should know all he can about his work, but if he knows nothing else he handicaps himself. He is a dreadful bore and he shuts out from himself some of the brightest and best things of life. By devoting thought to the use of your leisure time you may do much to acquire these attributes that the colleges give so well.

Concerning the practical character of your education and the value of studying while working—let me tell a story of a new technical school graduate. He entered railroad service in the motive power department and was given the problem of designing steel tanks for compressed air. These tanks were 30 in. in diameter by 7 ft. long. The designer, who had never had the advantage of shop experience, showed on his drawings bumped heads, turned outward, bringing the rivet heads at both ends on the inside of the tank. The practical master mechanic, who had the order to make these tanks, called the youth's attention to the fact that in order to build the tanks it was necessary to leave inside the man whose duty it was to hold on to the heads of the rivets. He said he would not raise the point of leaving a man permanently inside of the steel tanks if he had only one or two to make, but as the order called for thirty he drew the line at losing so many men. The young draftsman there and then learned a lesson of great importance. He turned the heads about, leaving the rivets on the outside. He learned the lesson too late, because by that time the story was all over the shop. Chances for promotion are sometimes seriously affected by such mistakes, which your education would not permit you to make.

And here is one on the college boy: "I thought your father wasn't going to send you back to college," said a friend. "That's so, Dad did kick on the expense, but I threatened to stay at home and help run the business. Then he decided that a college course would be a lot cheaper."

I would like to speak of the matter of greatest importance in education. I refer to the development of character. If education is not reflected in character it is worse than useless. There never was a time when such great opportunities presented themselves to those who are prepared to take advantage of them. Every official in a large organization is more troubled with problems of personnel than by any other problems. Character is even more important than ability in the eyes of your employers and the traits of character most sought for are thoroughness and reliability. If your education does not develop these traits it has fallen far short of what it ought to do.

A word about ambition. You greatly need ambition, but ambition of the right kind. The right kind is that which inspires you to do the work that lies before you more perfectly than anyone else has ever done it. It should also be done quickly and efficiently This ambition is sure to lead to success of the best kind and is the best assurance of the attainment of the highest position anyone is qualified to fill. That ambition which leads one insanely to desire a position far beyond his capacity to fill and leads him to attempt to omit vitally important intermediate steps in progress is the wrong kind and leads to failure and discontent, and to never ending complaints of the coldness of the world and its lack of appreciation. The men who are most wanted today are the men who can do something that someone else wants done and do it quickly and do it right. "He does much who does a little well." This is really covered by my understanding of the words character and ambition in this connection.

"Remember that promotion is the result of growth, not of time serving, and that the oak outlives the mushroom."

Hugh Chalmers, famous in the automobile world, has said: "There are three kinds of men.

1. "Those you tell once and the thing is done.
2. "Those you tell and the thing is never done.
3. "Those you don't tell at all and they beat you to it."

I am reminded of the fact that this school undoubtedly owes its existence chiefly to an inspiration which came to Edwin M. Herr 18 years ago while journeying in Europe, where he observed the German shop schools in operation. Many years passed before he found the opportunity to build this educational structure. You should pay tribute to those who have conceived, planned and executed to give you these opportunities. You are wonderfully fortunate. It should not be possible for you to forget for a moment that much is expected of you because of these opportunities, and I do not believe you will forget.

In New York City, Sunday, March 30, last, Miss Helen Keller made the most remarkable address in the history of the world. She said—"I was deaf, and I hear; I was blind, and I see; I was dumb, and I speak." Mastery of speech by one completely deaf, dumb and blind is truly the "greatest individual achievement in the history of education."

Think for a moment of the use this young woman has made of her opportunities. Think of the degree won by her at Radcliffe College. Think of the significance of the word "opportunities" as applied to Miss Keller. Think of the possibilities of education of others similarly afflicted which are revealed by this remarkable case. No greater inspiration than this is to be found for doing our best with our opportunities. The world owes a tribute to Mrs. Macy, Miss Keller's teacher, for the emancipation of this imprisoned soul. We likewise owe tributes to our teachers, and we owe debts to them which we can pay only by making proper use of the opportunities they have placed in our hands.

You have inherited. What will you bequeath? Give serious thought to this question. We may receive for a time, but we must also give. Without making an end of receiving we must do our share in reaching out the helping hand.

What do you desire? Do you desire success? What is success? Is it riches? Is it position? Is it power? In my way of thinking there is no success like that of making the greatest possible number of people glad that you have lived. Let me suggest that you so order your lives that some day someone will be grateful to you as you are grateful to those who have placed before you this magnificent opportunity.

PASSENGER ALARMS IN VICTORIA.—During the last few years the Victorian Railways have been equipping the passenger cars on express trains with communication alarms. The apparatus, which is similar in principle to that adopted by the English railways, is operated by means of a chain running through pipes under the roof of the car with openings opposite each compartment. The chain is connected to a rod fixed outside one end of the carriage and when pulled by a passenger it turns the rod and causes the application of the brakes sufficiently to attract the attention of the guard and driver but at the same time without enough force to stop the train suddenly. The chain also turns a red disc which is provided outside the end of the carriage to indicate the compartment from which the alarm has been given.

NEW STEAM CARRIAGE.—A steam carriage constructed by Col. Macirone and J. Squire, Paddington-wharf, and which professes to be by the superiority of its peculiar boiler, and the simplification of its machinery, a decided improvement on all former vehicles of that description, has been exhibited for some time past in the neighborhood of Paddington. We drove out in it a few days ago along the Harrow-road with, in all, 11 persons. The utmost velocity on level ground was near 10 miles an hour; a part of the road covered with a coating of loose wet pebbles was crossed at a rate of about eight miles; and the bridge over the Grand Junction Canal, where the steep is rather a smart one, at four or five miles an hour.—Quotation from the London *Times* in the *American Railroad Journal,* January 19, 1833.

MECHANICAL TERMINAL FOR ILLINOIS CENTRAL

The One at Centralia, Ill., Represents the Latest Practice in Car and Locomotive Repair Plants.

BY WILLARD DOUD.*

The Illinois Central recently completed and put into operation at Centralia, Ill., a large locomotive terminal and car repair plant. Centralia is located about 250 miles south of Chicago, on the main line, in the midst of a large bituminous coal producing section, and at a point where all northbound traffic is separated for northern and western points. It is one of the most important freight terminals on the Illinois Central system. Formerly there were located at Centralia a 24-stall roundhouse, an 8-pit locomotive repair shop, and small freight car repair yards. These were all on a small tract of land practically in the center of the city and in a position which would not admit of any satisfactory alterations to the old plant to render it suitable for handling heavy locomotives rapidly and making repairs to about 250 freight cars a day. The original shops on this location were built about 1850.

The decision to locate new and larger distribution yards about two miles south of Centralia carried with it the building of a new roundhouse with light repair facilities, and a freight car repair yard suitable for handling repairs to about 300 cars per day. The work was started on the mechanical terminal during July, 1912. The freight car repair yards were put into operation December 10, 1912, and the locomotive portion of the terminal one month later.

Because of the shape of the ground available it was necessary to make the locomotive and car departments practically independent of each other as far as the common use of the buildings was concerned, and in the design of the plant and the location of the various buildings the roundhouse and car repair yards are entirely separate, being some 2,000 ft. apart.

Practically 100 locomotives are handled in and out of the Centralia terminal each 24 hours, and the determination of the number of stalls for the new house was based on this figure, one stall being provided for every two engines handled per 24 hours. This is believed by the mechanical department of the railroad to be quite conservative, and sufficient to allow for the ready handling of 150 engines every 24 hours.

The portion of the terminal concerned in the handling of locomotives consists of the following facilities: A 48-stall roundhouse; machine, boiler and smith shops; storehouse and offices; 600-ton coal chutes and sand drying plant; inspection pit, with office for engine inspectors; cinder pit, with shelter for cinder pit laborers; roundhouse office and enginemen's locker room and lavatory and power house.

ROUNDHOUSE.

The roundhouse is laid out on a 50-stall circle having one opening accommodating two tracks on the south side. The outside wall and the partitions are constructed of brick and the timber roof is covered with composite board. The building is especially noteworthy for the lighting and ventilating effects obtained. The roof is somewhat higher than is usually found with roundhouses of like section. A ridge ventilator is provided around the roof of the entire house for ventilation, and the experience gained during the past winter has demonstrated that this type of ventilator is very effective in removing smoke and fog from the interior of the house.

General View of Locomotive Group.

The roundhouse has 39 stalls designed for the storing and the handling of running repairs to the locomotives, each of the stalls being equipped with the usual pit. Nine of the 48 stalls, or one section of the roundhouse, is designed for drop pit work, and the general overhauling of such engines as are generally given heavy repairs at this shop. A drop pit for handling driving wheels serves seven of the nine stalls, the pit being provided with two 30-ton Watson-Stillman hydro-pneumatic drop pit jacks. An engine truck drop pit serves the remaining two tracks; it is equipped with a Watson-Stillman 15-ton hydro-pneumatic jack.

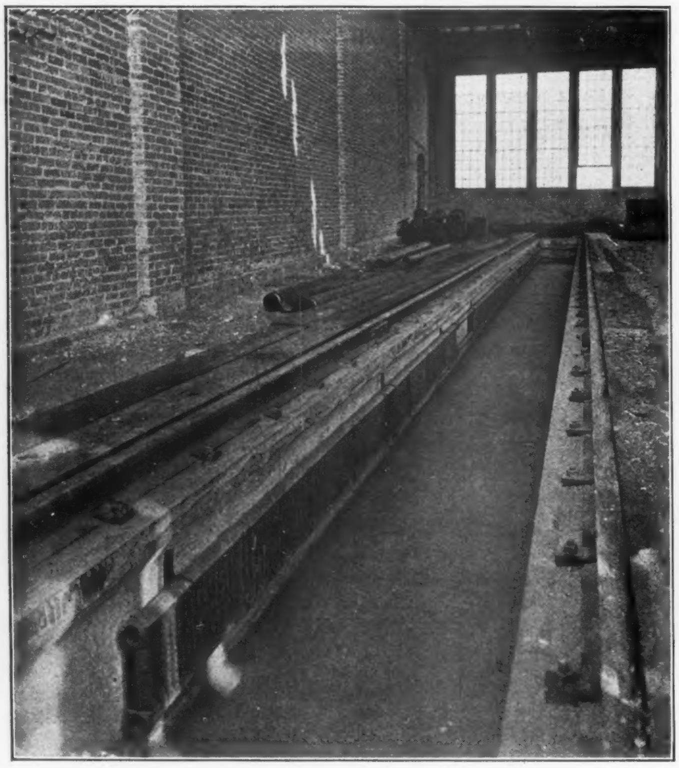
The floor in the heavy repair section, as well as in the remainder of the house, is of vitrified paving blocks, laid on a

*Mr. Doud was formerly shop engineer of the Illinois Central and handled the mechanical details of this new terminal.

foundation of rolled sand, with a generous crowning to provide good drainage to the pits. The bricks, after being laid and tamped, were slushed with cement grout, and after setting make a very satisfactory roundhouse floor.

The cross section of the stalls devoted to heavy repairs differs from the remainder of the house, sufficient variation being made to permit of the installation of a 7½-ton electrically operated girder crane. This crane, which is operated on 3 phase, 60 cycle, 440 volt, alternating current, was made by the Whiting Foundry Equipment Company and is of their special compensated gearing type for operating on circular runways. Extending around the outer ends of the 48 engine pits is a 24 in. gage material track, for handling material on special push cars to and from the machine, smith and boiler shops. The running repair portion of the roundhouse is equipped with cast iron smoke jacks, 12 ft. long, made by the Paul Dickinson Company.

Fuel oil for kindling fires is furnished by two Bowser long distance rotary oil pumps, placed in the first and third sections of the roundhouse from the heavy repair shop end. The fuel oil handled by these pumps is stored in the basement of the

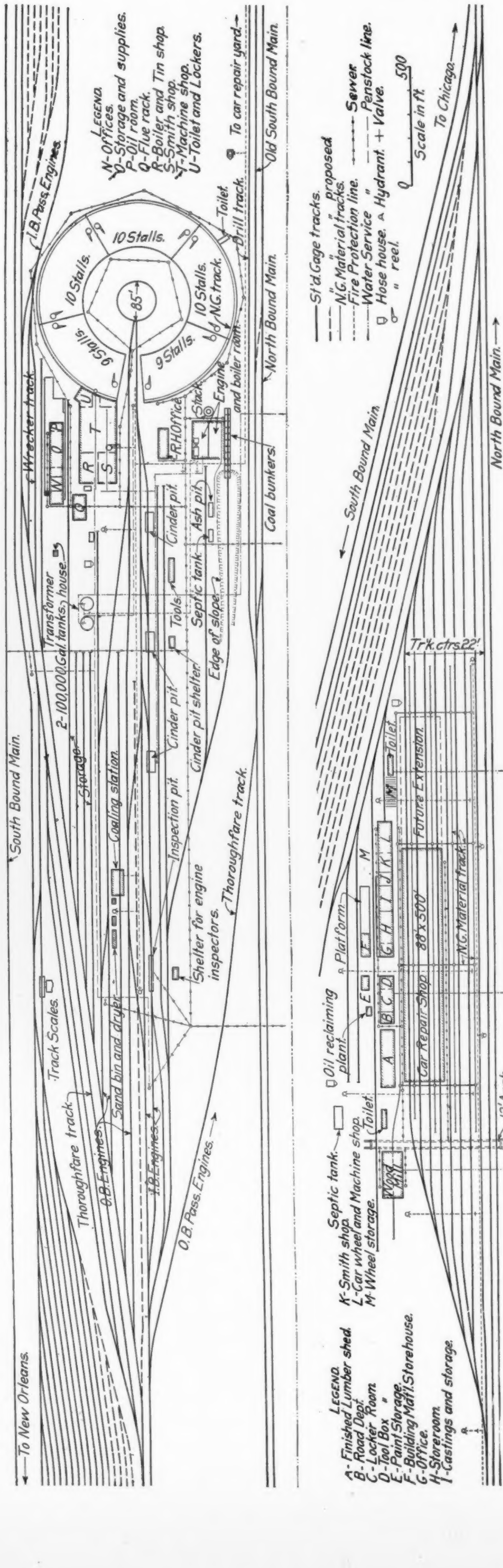


Typical Engine Pit.

oil house in a 12,000 gal. tank, about 800 ft. away, and there is no trouble experienced in drawing the oil from such a distance.

An innovation in the heating of roundhouses is presented in the use of cast iron wall radiators in the engine pits and on the outer circle wall pilasters, instead of the usual iron pipe coil radiators. Each pit has 432 sq. ft. of radiating surface and the total for the house, including the wall radiation, is 26,000 sq. ft. During the past winter the cast iron radiation has given entire satisfaction, and it is believed the experience gained in this roundhouse, which is the first in which cast iron radiation has been used, will warrant its further use in roundhouses where the corrosive action of smoke and water is very severe on steel and iron pipe. Exhaust steam from the power house is used for heating in all of the buildings in the locomotive department.

The engine house is lighted by high intensity Tungsten lamps, three of 250 c. p. being placed between the engine pits. This gives a very good light for night work. Supplementing the

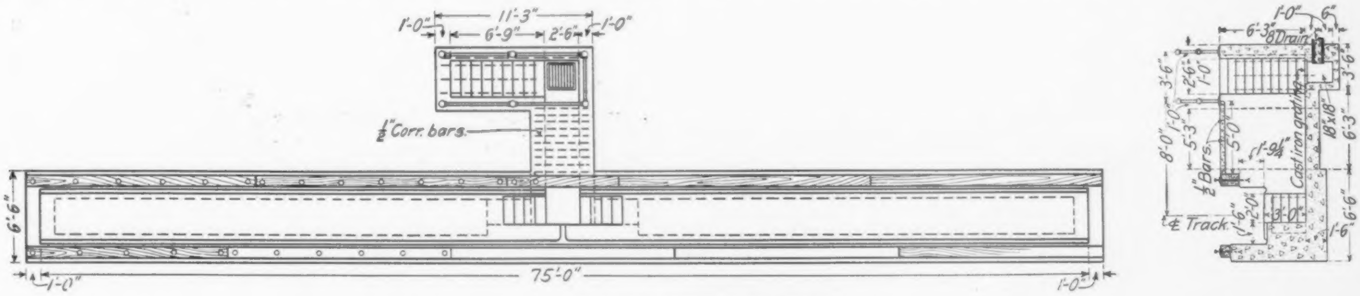


General Arrangement of Mechanical Terminal at Centralia, Ill.

tungsten lighting units are four Westinghouse receptacles for extension cord plugs located between the pits.

An innovation in roundhouse electrical practice is provided in the placing of a 3-phase 440-volt power circuit along the wall of the outer circle, connection with which is made to 3-phase plugs located at each stall for the operation of portable tools, such as lathes, boring bars, flue cutters, etc. A motor-driven emery grinder is placed in the roundhouse opposite the machine shop for sharpening tools and general grinding.

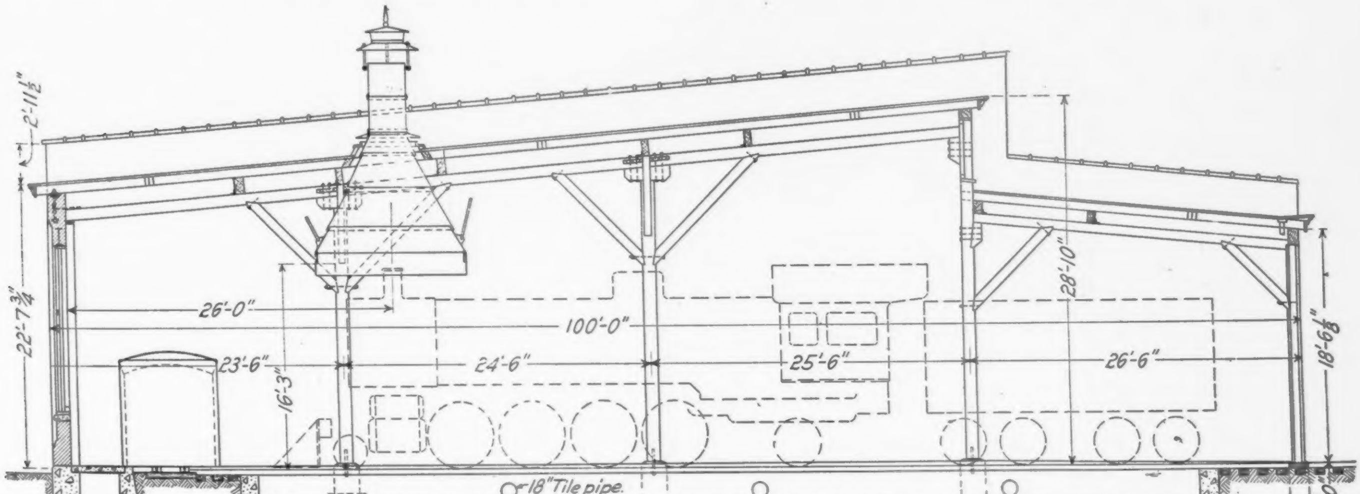
The roundhouse is served by an 85-ft. turntable of modern design, which is operated by a Nichols electric tractor designed to turn the table through one revolution under load in one minute. An inspection pocket is provided in the wall of the turntable pit for oiling and inspecting the tractor.



Detail of Inspection Pit.

MACHINE, BOILER AND SMITH SHOPS.

With the exception of a portable lathe and motor-driven emery grinder in the roundhouse, all the machine tools for handling repairs to locomotives are located in the machine, boiler and smith shops. These facilities are contained in a fire-proof building 170 ft. long by 80 ft. wide, constructed with brick walls, concrete roof and steel window sash, and located adjacent to and connecting with the heavy repair section of the roundhouse.



Section Through Engine House.

Two lines of narrow-gage and one of standard-gage track serve these shops. Between the shop buildings and the roundhouse are located the shop and roundhouse lavatory, locker room, and the tool room, which is arranged to serve both the machine shop and roundhouse.

The machine shop proper consists of two 40-ft. bays, one served with a 5-ton, floor-operated electric crane, under which all tools for handling heavy work are located. All tools in this bay are motor driven, while those in the other bay are belt driven and arranged in two groups. The machine tool equipment of the shops is very complete, and includes the following motor driven tools:

Morton 32 in. draw cut shaper.
Lucas 50 ton forcing press.
Bickford 72 in. heavy duty radial drill.
American 36 in. engine lathe.
Ransom 24 in. double emery grinder.
Chambersburg 600 ton driving wheel press.
Bausch 42 in. boring mill.
Pond 36 in. x 12 ft. planer.
Schumacher & Boye 30 in. x 10 ft. engine lathe.
Niles 90 in. driving wheel lathe.

This equipment is located under the crane and is all new with the exception of the last four machines, to which motors were applied when the equipment was moved from the old shops.

The belt-driven tools, all of which were used in the old shops, are as follows:

Acme 3 spindle bolt cutter.
Pond 30 in. x 12 ft. planer.
Grindstone.
Jones & Lamson 2 in. x 24 in. turret lathe.
Niles 36 in. boring mill.
Whiton centering machine.
Barnes 36 in. vertical drill.
Barnes 42 in. vertical drill.
Niles 18 in. shaper.
Wet grinder.
Hack saw.
Schumacher & Boye 24 in. x 10 in. engine lathe.
Reed 14 in. x 8 ft. engine lathe.
Reed 12 in. x 8 ft. engine lathe.
Niles 18 in. x 12 ft. engine lathe.

Located in the tool room is the following equipment, all of which is motor driven:

12 in. double emery grinder.
Cincinnati milling machine.
Yankee drill grinder.
Sensitive drill.

The boiler shop is equipped with the following tools, all of the power tools except the flue swedger being motor driven:

Hillis & Jones 30 in. punch.
Hillis & Jones 30 in. shear.
Ryerson flue cutter.
Ryerson flue cleaner.
Ryerson flue welder.
Flue furnace.
Air flue swedger.
Forge.
Flanging fire.
Air flanging clamp.

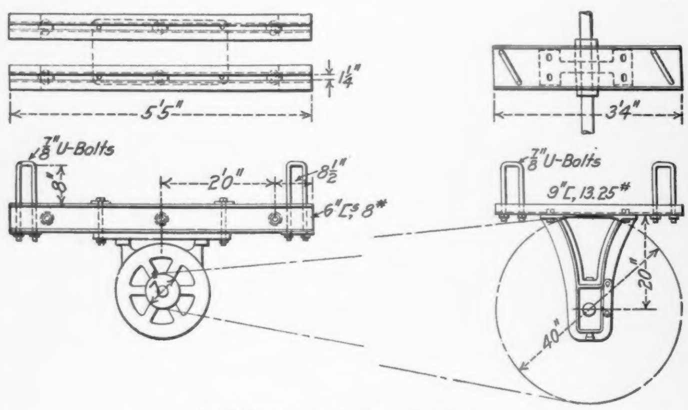
Located in the smith shop is the following equipment:

Alligator shear (motor driven).
Beaudry 200 lb. power hammer (motor driven).
1,000 lb. steam hammer.
Five forges.
One oil heating furnace.

All of the motors used in the shops are operated on a 3-phase,

60-cycle, 440-volt alternating current circuit. Westinghouse motors were used on all new tool equipment and General Electric motors for group drive and application to all old tools. In the purchase of new tool equipment for these shops special attention was given to the selecting of tools which would give the desired speed variations with the use of constant speed alternating current motors. On some of the old tools two-speed motors are used to get the proper operating speeds for the class of work handled.

The lighting of the shops is by means of high intensity tungsten units, varying from 100 to 250 watts capacity. A generous distribution of extension cord receptacles is provided for emergency use when general illumination will not suffice. Exhaust steam is used for heating this building, as well as all others in the locomotive department, cast iron wall radiation being used throughout in connection with a vacuum system and Webster vacuum valves.

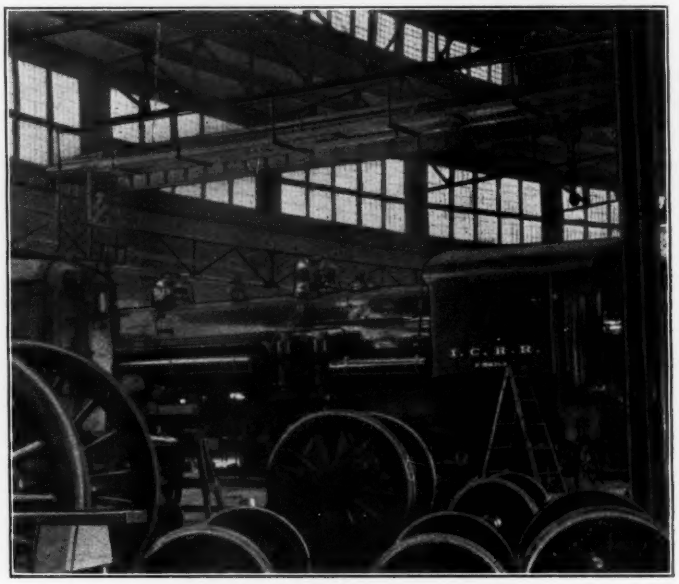


Shafting and Motor Supports.

OTHER BUILDINGS IN LOCOMOTIVE GROUP.

The roundhouse office is a brick structure 65 ft. x 20 ft., located just south of the roundhouse and across the entrance tracks from the machine shop. This building, which also contains the lavatory and lockers for the enginemen, is very complete and has all modern conveniences for the use of road employees. About 300 well-ventilated all-steel clothing lockers of generous size are provided in a separate room, which is adjacent to the lavatory, containing shower baths and other first-class toilet facilities for use of the enginemen. Offices for the traveling engineer, the boiler foreman, the roundhouse foreman and a registry room are also included in the building.

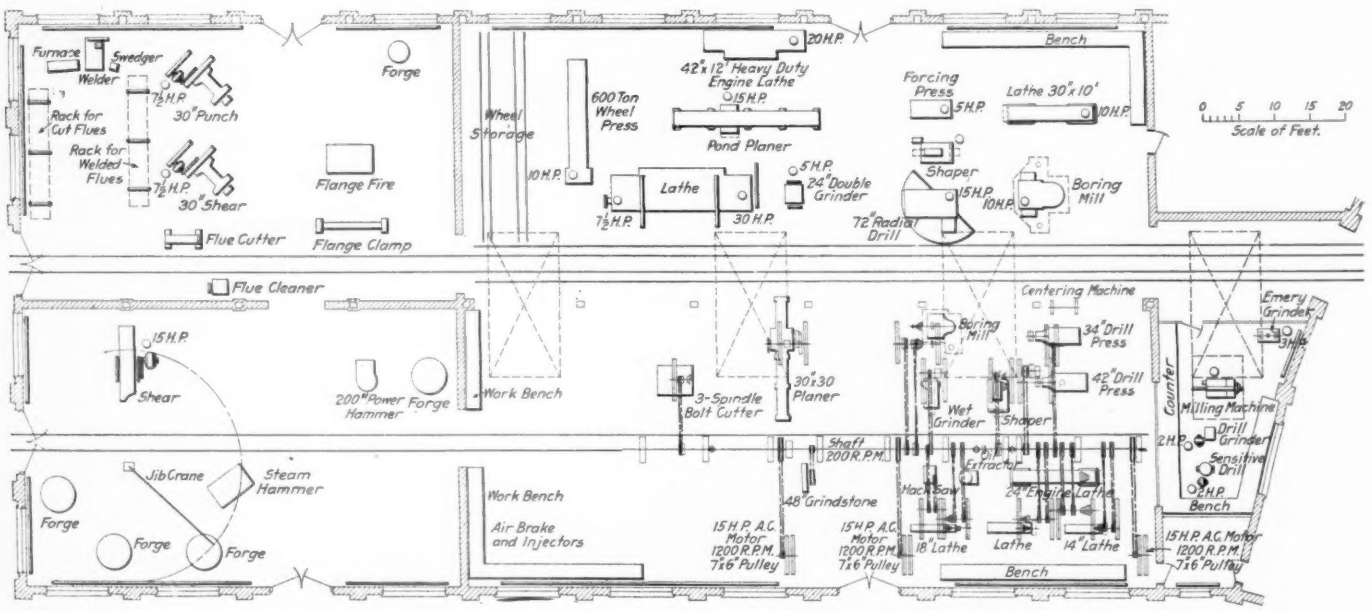
Coal Chute.—The coal handling plant for supplying locomotives is a timber chute having a capacity of 600 tons. It was built complete by the T. W. Snow Construction Company, Chicago, and is of the double bucket or semi-balanced skip-hoist type, in which coal is unloaded into a depressed hopper from which it is delivered and elevated automatically to the storage bins above. The coal-hoisting apparatus of the plant is operated by a 10 h. p. General Electric induction motor.



Interior of the Erecting Shop Section of the Roundhouse.

Combined with and adjacent to the coaling plant are facilities for storing and drying engine sand. Storage capacity for 12 cars of sand is provided and one stove drier is used. After drying the sand is elevated by compressed air in the usual manner, the delivery pipe to the storage bins in the coal chute being fitted with removable back ells, made by the Green Engineering Company, Chicago, where changes in direction are made. These fittings have been found to practically eliminate the troubles from wearing through of sand discharge piping at bends.

Inspection and Cinder Pits.—An inspection pit is provided on the incoming engine track near the coal chutes, with an office



Arrangement of Tools in the Machine, Smith and Boiler Shops.

and shelter for inspectors located convenient to it. The intention of the management is to develop the use of the inspection pit as much as possible and attempt to handle as many of the minor repairs to locomotives as can conveniently be done at this place, instead of in the roundhouse.

There are three single engine cinder pits from which the cinders are removed by a locomotive crane using a clam-shell bucket. This type of cinder pit might be considered as the standard of the Illinois Central and according to the officers of the motive power department gives entire satisfaction. Adjacent to the cinder pits a frame shelter building is located containing provisions for drying clothing, and lockers for the use of the men working on the pits. Located north of the cinder pit shelter is a building for the storage of tools used by enginemen while on the road. Scoop shovels, picks, water jugs, water pails, lanterns and oil cans are cared for in this building in a systematic manner, the equipment being gathered, cleaned and cared for by an attendant, who delivers it to enginemen.

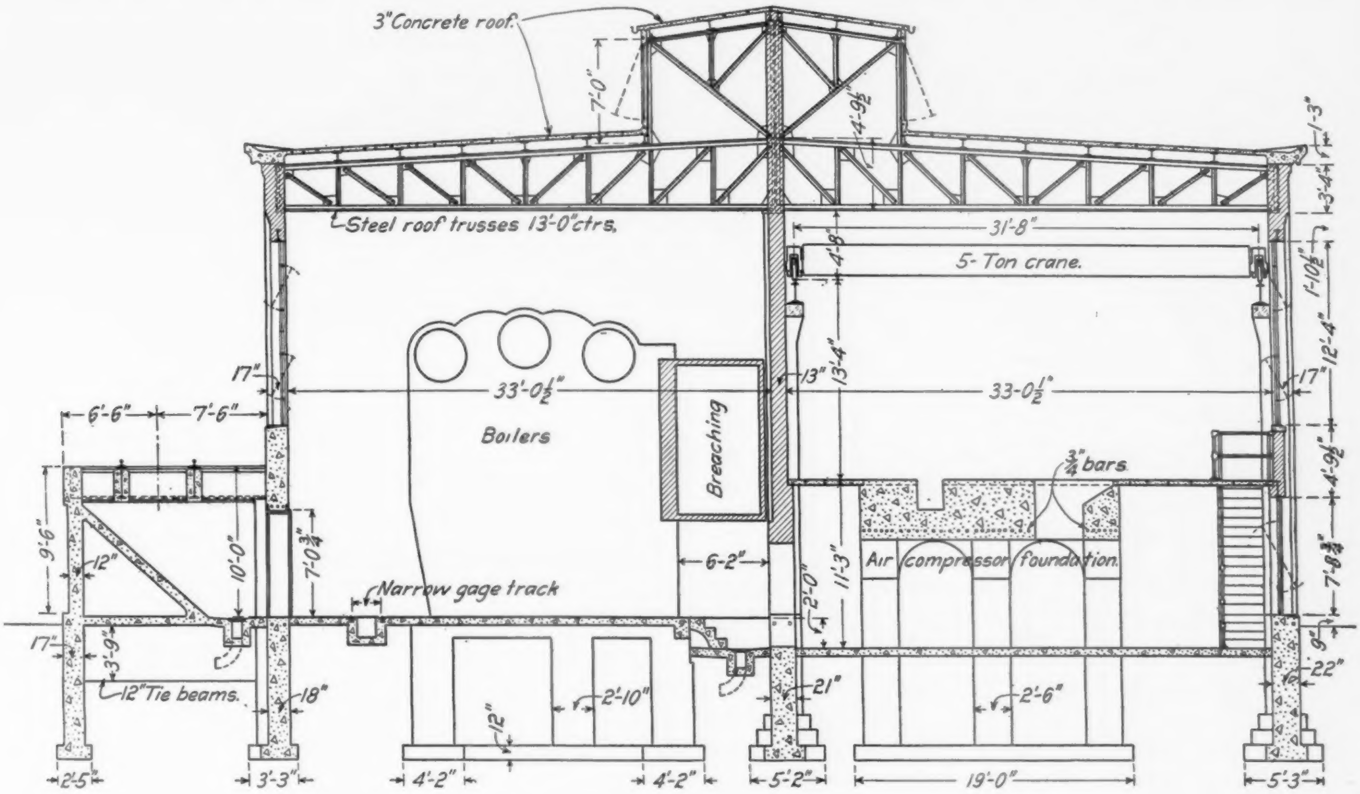
Storehouse and Office.—This is located close to the machine, boiler and smith shops, and roundhouse. The building is 175 ft. long by 30 ft. wide. A second story extends over 75 ft. of the building, the space being utilized for the storage of records, class room for apprentices, telephone exchange and rest room for enginemen. The rest room is equipped with 20 comfortable steel bunks and lounging facilities for use of enginemen off duty. On the first floor of the building are located the offices of the division master mechanic and storekeeper, the storeroom and the oil and waste rooms. The oil room possesses some unique features in the apparatus for handling oil, power pumps being provided for the handling of fuel, car and kerosene oils from the storage tanks in the basement to faucets for filling barrels on the platform. This arrangement has been found to work satisfactorily, as barrels need not be brought into the small pump room for filling. Separate tanks are provided for storing the following kinds and quantities of oils:

Fuel	12,000 gals.	Valve, superheated	1,600 gals.
Kerosene	3,500 gals.	Signal	1,200 gals.
Car, summer	3,500 gals.	Mineral seal	500 gals.
Car, winter	3,500 gals.	Black	500 gals.
Valve, saturated	1,600 gals.		

Hand pumps of the self-measuring type are provided for handling all of these oils. Hand pumps are also used in the roundhouse and boiler and smith shops for handling fuel oil for kindling fires and for use in oil furnaces. Adjacent to the oil room is a waste storage space of sufficient size to carry a 30 days' stock of waste. The entire oil house equipment was installed under contract by S. F. Bowser & Company, and the pump tanks and piping represent this company's latest efforts in modern oil-house equipment. Lighting of the building is by tungsten clusters, with the exception of the oil rooms, where single tungsten lamps are encased in vaporproof globes and receptacles.

POWER HOUSE.

One of the most important buildings of the locomotive group is the power house, which is a fire-proof structure made of brick and concrete. On account of the extensive area over which the railroad company's operations in Centralia are scattered, and the general use of electricity throughout the various plants, and the lack of dependable central station service, it was decided to install an up-to-date electric plant for producing current at a minimum cost. Considerable expense was incurred and much thought was given to the design of the plant.



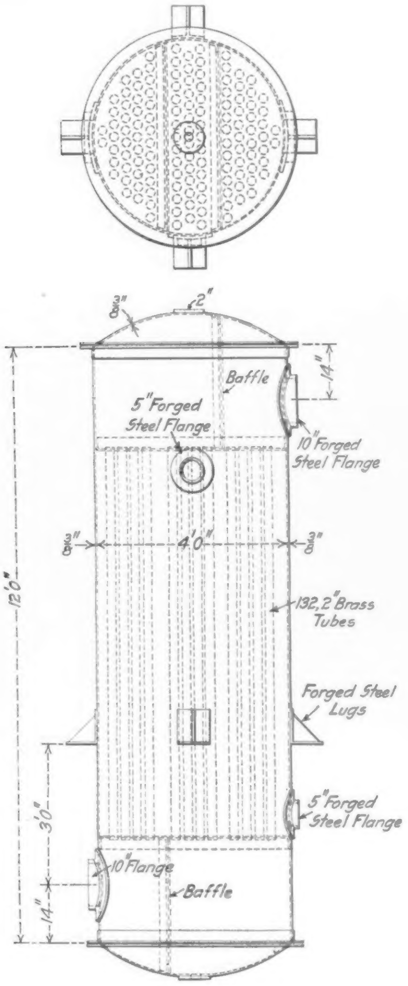
Section Through Power House.

The equipment of the boiler room consists of four 250 h. p. Stirling water-tube boilers (hand fired) operating at 150 lbs. steam pressure; a Cochrane horizontal feed water heater of 2,000 h. p. capacity, and two 10 in. x 8 in. x 10 in. Blake-Knowles duplex boiler-feed pumps of the outside center packed, plunger type fitted with Fisher governors.

A reinforced concrete chimney 200 ft. high, having an internal diameter of 7½ ft., disposes of the gases of combustion from the boilers. It is provided with a fire clay tile lining 70 ft. high, and the breeching connection between the boilers and stack is made of selected common brick, laid in cement mortar. The chimney was designed to allow of the operation of the four 250 h. p. boilers at a 50 per cent. overload, the grate surface in the boilers being proportioned accordingly. While the requirements of the plant probably never will call for the operation of the boilers under the above circumstances, conditions are obtained

for the burning of a very low grade of fuel with assurance of plenty of steam at all times.

The engine room is provided with two 250 k. v. a. 3-phase, 60-cycle, 440-volt, 3,600 r. p. m. General Electric turbo-generators running non-condensing; two 14 in. x 24 in. steam x 22 in. x 13 in. air by 18 in. stroke, cross compound, two stage, Laidlaw-Dunn-Gordon air compressors, providing an air pressure of 110 lbs., and having a capacity of 1,030 cu. ft. of free air per minute at 130 r. p. m.; a 1,000 gallon Alberger centrifugal fire pump, direct connected to a 100 h. p. General Electric induction motor; a 15 k. w. General Electric motor generator exciter operating at 125 volts, and a 15 k. w. General Electric turbo generator exciter operating at 125 volts; a 10 panel black marine slate switchboard, Westinghouse Electric & Manufacturing Company; an exhaust steam hot water heater for the car department heating system; a 5 in. Jeanesville Iron Works centrifugal circulating pump operated by a Terry turbine; two Marsh vacuum pumps for handling the heating system returns; two Adams Bagnall series arc light transformers, and a McFell fire alarm system controlling switchboard and recording apparatus.



Water Heater.

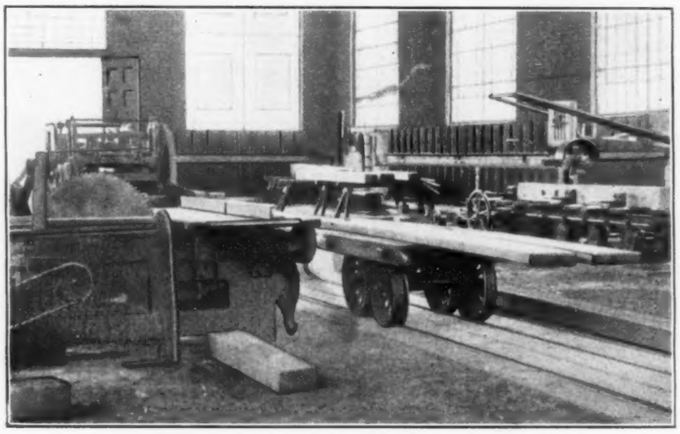
In addition to the above equipment the engine room is fitted with a 5 ton Whiting hand operated crane for handling repairs to machinery. A Richardson-Phoenix automatic oil storage and filtering system is also installed to handle all oil used by the turbines, air compressors and pumps. All drains containing any oil are run through the filtering system and the oil recovered. Space has been reserved in the north part of the engine room for the installation of modern locomotive boiler washing and refilling equipment.

Special attention has been given to the handling of compressed air, thermometers being applied to the first stage discharge and the second stage intake and discharge of the compressors for observation at all times of the temperature of the air. A cast iron after-cooler of unique design is placed north of the power house in connection with the air reservoirs, to effect a separation of contained moisture and reduce the temperature of the air. It is believed that this is the first instance where cast iron has been used for the purpose of cooling compressed air.

Electric power, in addition to being used for the operation of the motors and lighting in the locomotive and car departments, also operates motor driven air compressors at the hump and departure yards. Current also is used for lighting the freight yards and adjacent buildings, charging storage batteries, and is transmitted to Centralia for the lighting of the company property. In a general way the power house represents very advanced ideas in the economical production of electricity, steam and compressed air, and with the class of apparatus installed, and with its well planned arrangement, the hopes of the designers to be able to produce power at the lowest possible figure should be realized.

CAR DEPARTMENT.

The car department is located directly north of the locomotive group, the arrangement of the facilities being a double ended yard consisting of six active repair tracks and two storage tracks. Situated to one side of the repair tracks are the service buildings in which the necessary material used in the repairing of freight cars is stored and prepared ready for use.



A Corner of the Wood Mill Showing Hot Water Radiators.

The scheme of operation followed in designing the car department was to have a double ended yard to eliminate dead track space as much as possible, to provide a complete system of tracks for handling material to all parts of the yard, allow sufficient space for the storage of material, and make the operations of finishing material follow progressive sequence. That these conditions have been met is shown by the smooth operation and large output of repaired cars from the yard since the first day of its operation.

The following buildings are included in the car department group: Car repair shop; wood mill; oil recovery plant; dressed lumber shed; road department locker and lavatory, and tool room building; paint and oil storage building; and office, store, air brake, smith shop and car wheel shop building.

The car repair shop, which is 500 ft. long and 88 ft. wide, spans four repair tracks. It is an open ended structure, built entirely of wood and having a pitch and gravel roof. Skylights are spaced at frequent intervals, which makes the building very acceptable for working on dark and stormy days. Compressed air connections are provided on every fourth post of the shop.

The wood mill, in which all the wood making machinery is installed, is a fireproof structure built with brick walls, concrete and steel roof, and steel window sash. The machinery was placed in the building to allow of a progressive movement of material from

the lumber yard, located south of the mill, to the finished lumber shed and the repair yards on the north. The interior of the building presents a pleasing appearance with its large window areas and unobstructed overhead space. All machines are motor driven, and there is no belting of any nature extending above the tops of the machines.

The machine equipment of the woodmill, together with the horse power rating of the driving motor, is as follows:

Fay & Egan 4 sided dimension planer	50 h. p.	900 r. p. m.
Fay & Egan smoother	7½ h. p.	1,800 r. p. m.
Fay & Egan 5 in. x 24 in. planer	7½ h. p.	1,800 r. p. m.
Fay & Egan hand feed 24 in. rip saw	7½ h. p.	1,800 r. p. m.
Fay & Egan automatic cut-off saw	15 h. p.	1,600 r. p. m.
Fay & Egan 36 in. band saw	5 h. p.	1,200 r. p. m.
48 in. grindstone	3 h. p.	1,200 r. p. m.
Covel saw gummer	2 h. p.	1,200 r. p. m.
Covel knife grinder	2 h. p.	1,200 r. p. m.
Reciprocating vertical mortiser	3 h. p.	1,200 r. p. m.
20 in. turning lathe	2 h. p.	1,200 r. p. m.
Greenlee hollow chisel mortiser	15 h. p.	1,200 r. p. m.
Greenlee 4 spindle horizontal boring machine	10 h. p.	900 r. p. m.
Greenlee car gainer	15 h. p.	900 r. p. m.

The above machines, except for the Greenlee gainer, which is new, formed the equipment of the wood mill at the old shops, and required application of individual motors. Allis-Chalmers induction motors are used on all the machines except the gainer, which is driven by a Westinghouse motor. In applying the motors to the machines the Electric Controller & Supply Company Baehr flexible couplings were used. When auto starters are located at some distance from the motors, push button devices in series with the no-voltage release coils of the starters are provided for quick stopping of the motors.

The oil recovery plant is located in a small brick building south of the paint storage house. All old journal box "dope" is worked over and the excess oil removed and reused. The waste tanks are heated in the winter by connection to the heating system and during the summer by a small hot water heating plant located in a separate room of the building.

All lumber, which is purchased finished, and the surplus output of the wood mill are kept in a finished lumber shed located adjacent to the repair tracks. A brick building north of the finished lumber shed contains a shop for the handling of repairs to hand cars, baggage trucks, and other roadway material, a lavatory room for the car department employees, and a storage room for tool chests, jacks and other tools used by the car repairers. A separate fireproof building is provided for the storage of car paint and car oil. The oil storage tank is located in the basement of the building, and has a capacity of 3,500 gals. The oil is taken from the tank by a Bowser self-measuring plunger pump located in the oil recovery plant.

The north service building contains the office of the car department general foreman, store room for small material, an open space for the storage of heavy castings, an air brake and pipe shop, smith, and car wheel and machine shop. The storeroom has the usual complement of material cases, well arranged. The air brake and pipe shop is equipped with pipe threading and bending machines, and a new Westinghouse triple valve testing rack.

Located in the smith shop are three forges, equipped with individual motor-driven blowers, and a Beaudry 100-lb. power hammer operated by a 3 h. p. induction motor; also a pneumatic forging machine. The car wheel and machine shop contains the following equipment, all of which was removed from the old shops, and to which individual motor drive has been applied:

Double head bolt cutter	3 h. p.	1,200 r. p. m.
48 in. grindstone	3 h. p.	1,200 r. p. m.
36 in. vertical drill	3 h. p.	1,200 r. p. m.
Double head emery grinder	3 h. p.	1,200 r. p. m.
42 in. journal truing lathe	5 h. p.	900 r. p. m.
300 ton car wheel press	7½ h. p.	900 r. p. m.
Double head axle lathe	15 h. p.	900 r. p. m.
Car wheel boring machine	10 h. p.	900 r. p. m.

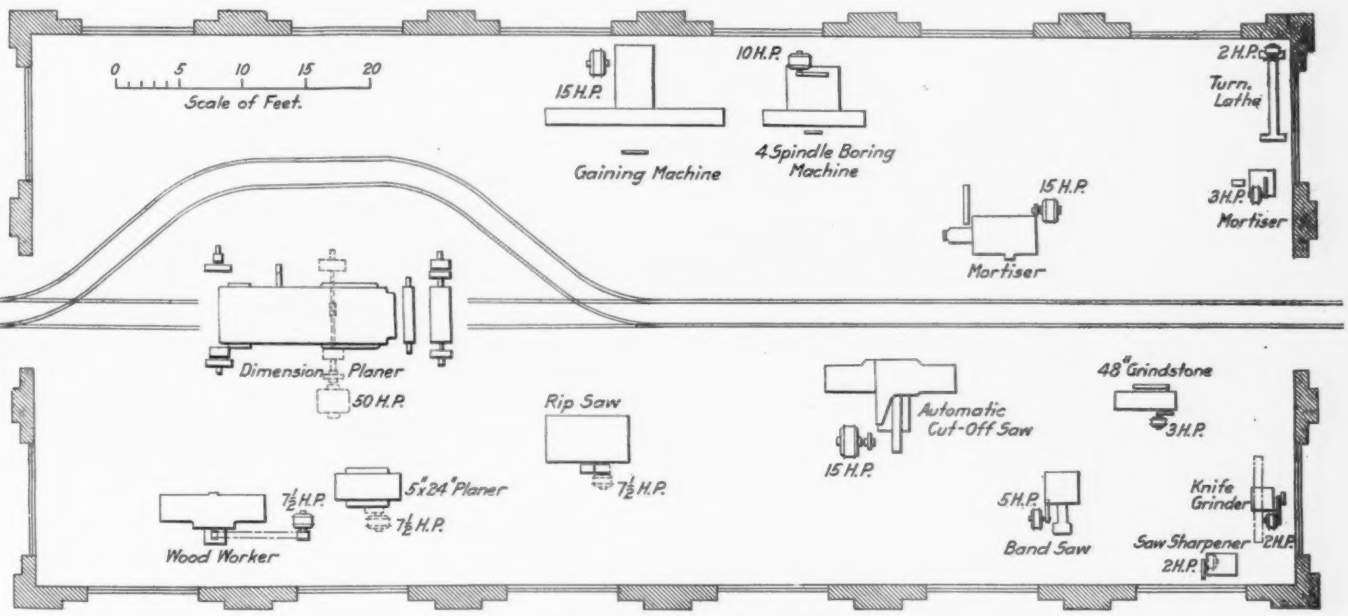
All motors used in the smith and car wheel shop were made by the General Electric Company.

The entire car department is well supplied with compressed air from the power house through a 4-in. line located above the ground in an accessible position for inspecting and repairing leaks. Air outlets located 75 ft. apart connected to an underground piping system are provided throughout the entire repair yards, excepting the portion under the shop, where the air outlets are located on building posts. Underground drainage tanks are located at several points to avoid as far as possible troubles with contained moisture in the air. The outlet boxes are made of cast iron, and were designed especially for this installation.

A very complete system of 24-in. gage material tracks and turntables is provided, the layout of the tracks allowing the handling of material from all shops on roller bearing cars to any point in the repair yards without carrying it over 25 ft.

No attempt has been made to provide any illumination of the car repair yards except in and around the service buildings and wood mill. In the various shops 300-watt tungsten lamps are used, while in the remainder of the rooms tungsten clusters using 60-watt lamps and 60-watt single tungsten units furnish the light which is entirely in the nature of general illumination.

Heating.—An innovation in railroad shop practice is the use

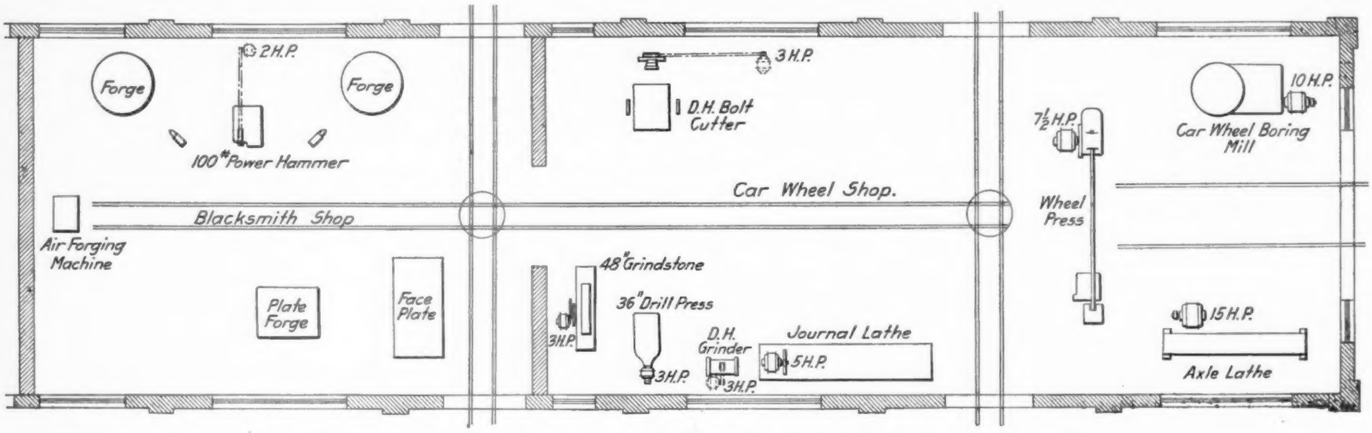


Layout of Machine Tools in the Wood Mill.

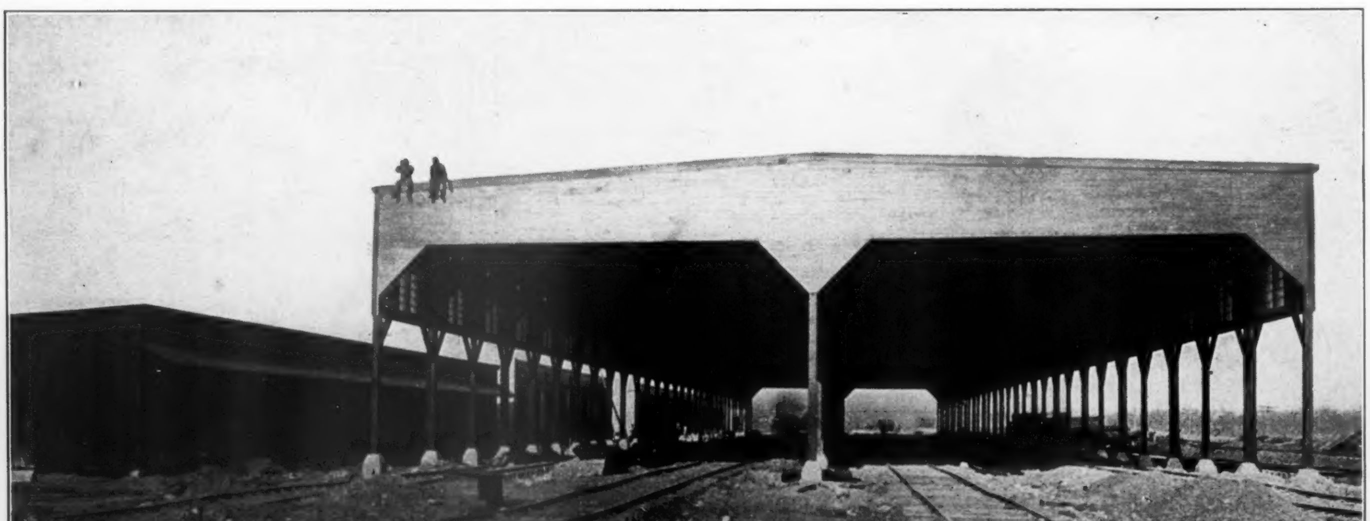
of hot water for heating all buildings of the car department. Heat for the system is obtained from a heater located in the engine room of the power house, which utilizes exhaust steam for heating the water. The circulation of the water is effected through two 5 in. pipe lines connected to a 5 in. Jeanesville centrifugal pump driven by a Terry steam turbine operating at 1,800 r. p. m. and located in the engine room basement.

From the power house to the various buildings of the car department the two 5 in. circulating lines of the system are contained in a concrete conduit. The radiation in all of the buildings is of the cast iron wall type and from observations taken during the past winter the hot water system has proved to be a decided success, satisfactory temperatures being maintained in the various buildings even under extreme low temperature conditions.

The maximum distance through which the hot water is transmitted in one direction in the heating system is 2,635 ft., the extreme building being the toilet located north of the service buildings in the car repair yards. The obtaining of satisfactory heat in buildings located at this distance from the source of heat supply is practically impossible with the use of low pressure steam under the ground conditions prevailing at Centralia, and the results obtained have fully justified the judgment of the engineers in departing from the usual practice of either using high pressure steam or providing a separate boiler plant conveniently located to furnish the required amount of steam.



Arrangement of Equipment in the Car Department Wheel and Smith Shops.



Open Car Repair Shed Before the Yard Was Surfaced.

GENERAL.

Electrical Distribution.—All current produced in the power house is of three-phase 440 volts. All the wires from the switchboard are run in conduit to a steel distributing tower located adjacent to the power house. Practically all transformers used for the locomotive department service are located on a concrete platform in the tower, about 7 ft. above the ground. By adopting this plan all voltage circuits above 440 volts, with the exception of two series arc circuits, are kept out of the power house switchboard. The circuits in the vicinity of the locomotive department are carried on structural steel towers so placed as to not interfere with building extensions or operation of the various terminal facilities.

Power is transmitted to the car department for light and power at 440 volts, a suitable transforming arrangement for obtaining low voltage for lighting being placed close to the center of distribution. Power is also transmitted to Centralia from the car department circuit, being transformed up to 2,300 volts. Electricity for light and power at the freight yards leaves the main distribution tower at 2,300 volts and is stepped down through transformers to the proper voltage at the various points where it is used.

Lighting of the entire terminal property, with exception of the freight yards, is by means of 500-watt tungsten units. The freight yards are lighted with series arc lamps, the transformers

for which are placed in the power house. The use of high intensity tungsten units for yard lighting service has proved entirely satisfactory, the volume and intensity of the light appearing to be better than that obtained from the ordinary arc lamp.

Telephone System.—An automatic telephone system provides intercommunication between all departments of the railroad company at Centralia. A 30-circuit switchboard of the Automatic Electric Company is installed in the second floor of the storehouse and office building. The decided success with the Automatic telephone system installed at the Burnside shops prompted the telegraph department officers to place a similar system at Centralia. The distribution of telephones is quite complete, an instrument being placed at every point where it could be used to advantage.

Water Supply.—Water for use in locomotives and for drinking purposes is obtained from the municipal water plant of the city of Centralia, through an 8 in. wood stave pipe, connection being made to the city mains at the city limits. Water storage is provided for at the terminal in two 1,000 gal. tanks of timber construction, located just south of the machine shop. On account of the water supply being of uncertain quality and at times unfit for drinking purposes during the late summer months, it was necessary to install a filter and purifier in connection with a separate piping system for distributing drinking water to various points around the plant, where bubbling fountains are provided. Alum is used as the purifying reagent when necessary, and as the filter and purifier is located in the roundhouse where plenty of steam is available for sterilizing, drinking water obtained from the filter and purifier should be of uniformly good quality.

On account of the close proximity of the terminal to large farming interests, some treatment of the sanitary sewage was necessary to render it suitable for discharging into drainage ditches. This condition is obtained through the use of concrete septic tanks, one each being located in the car and locomotive departments. These tanks are designed to retain the sewage for a period of 24 hours, which will allow sufficient time for partial disposal by bacteriological means of the objectionable contents.

All engineering incidental to the design and construction of the entire plant, including the freight yards, was handled by the engineering and mechanical departments of the railroad. The mechanical details were handled by the office of the shop engineer, under the supervision of M. K. Barnum, general superintendent motive power. The design and construction of the buildings was executed under the supervision of F. L. Thompson, engineer of bridges and buildings, and J. A. Taggart, reporting to A. S. Baldwin, chief engineer. T. S. Leake & Company, of Chicago, were the general contractors for all masonry and building work excepting the coal chutes. Kehm Bros. Company, of Chicago, installed all steam and hot water heating and steam and compressed air piping throughout the entire plant.

LONG DISTANCE FLIGHT.—A French aviator, Marcel G. Brindejonc des Moulinais, recently flew from Paris to Warsaw, by way of Berlin, a distance of 932 miles, in thirteen hours, and excluding stops, obtained an average speed of 93 miles an hour. He accomplished this in the competition for the Pommery cup for the longest flight across the country from sunrise to sunset in one day. He landed at Wanne, in Prussia, at 8 a. m. and in Berlin at noon.

SUNDAY TRAINS IN SCOTLAND.—An influential deputation of Scottish religious bodies waited upon the Caledonian Railway board of directors to press home the public outcry against the Sunday railway service which is to be inaugurated immediately. Sir Charles Renshaw, refusing the prayer of the petition, said the Scottish railways had not by any means moved rapidly in the direction of developing Sunday traveling. The public demanded it, and, as Glasgow cars had long since given these facilities and citizens had not objected, there was no reason why railways should not share in the traffic.

FALSE ECONOMY IN DRAFTING

BY C. J. MORRISON.*

Frequently much pressure is brought to bear on the drafting room to effect economies, and many methods have been suggested whereby the desired savings could be secured. Much money can be made or lost by the methods followed in the drafting room, but possible economies in this department must be considered from all standpoints. A few dollars saved on

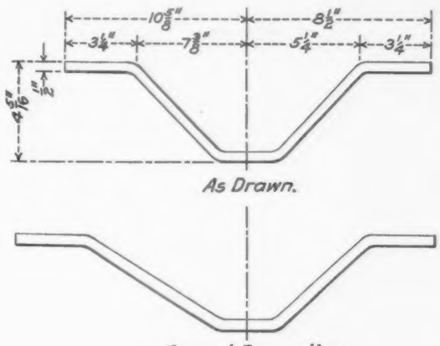


Fig. 1.

drawings may lose many dollars in the manufacturing departments.

Recently a large concern, as a matter of economy, stopped making drawings to scale. This step may save a trifle on the first cost of drawings, but is liable to lose many dollars in the course of manufacture. Even the economy in the drafting

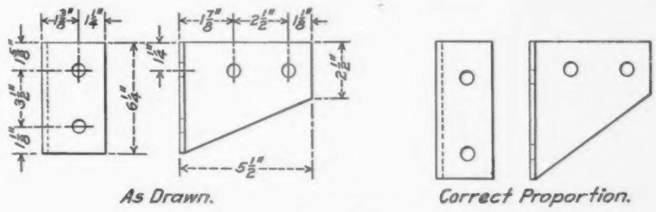


Fig. 2.

room is doubtful, as it takes nearly as long to make a haphazard drawing as to prepare one to scale. Furthermore a drawing is supposed to represent an article so that it will be recognized by one familiar with drawings, and drawings fail in this essential unless made to scale.

A few actual examples are shown which will illustrate the

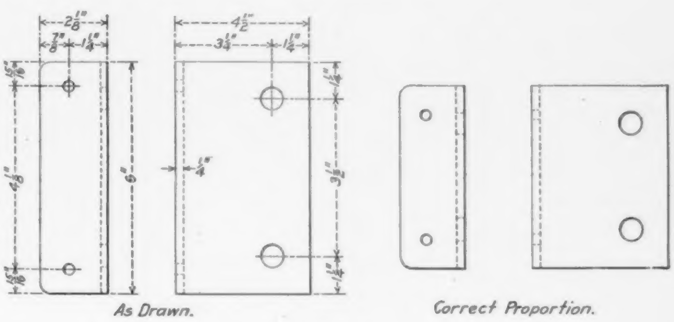


Fig. 3.

difficulty in using drawings which are not to scale. In each case the drawing is shown as actually made, and also as it would appear if drawn to scale. Some of the illustrations give only one view, as the other views would add no information.

In the drawings reproduced in Figs. 1 and 2 entirely wrong

*Chief Engineer, Froggatt, Morrison & Co., New York.

impressions are given as to the shapes and sizes of the pieces represented and a continual, careful check is necessary to avoid mistakes. Not only this, but both drawings fail to give a single over-all dimension. A checker is liable to fail to recognize the

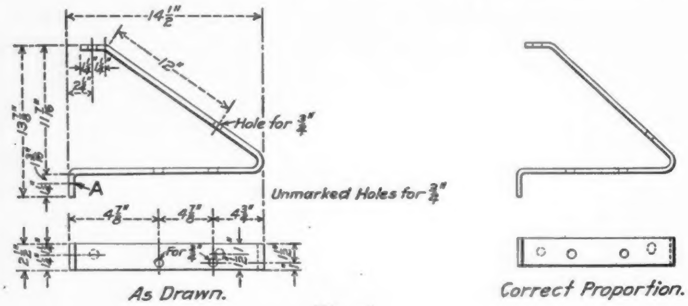


Fig. 4.

pieces in the shop. Fig. 3 shows an example which is so dangerous as to scarcely need comment. Fig. 4 illustrates how a saving at one point will give a loss at another. Care has been taken to mark the size for every hole except one, then the in-

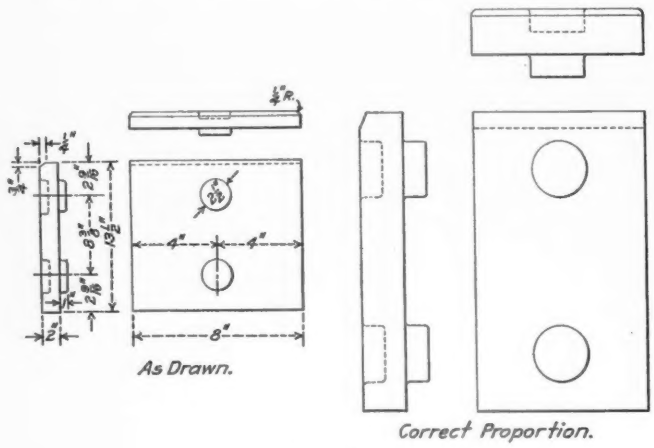


Fig. 5.

formation is added, "Unmarked holes for ¾ in." There is in all probability a hole at the point *A*, but the drawing does not show it. If economy is desired, why should the holes be drawn when the location of the centers and a statement, "All holes

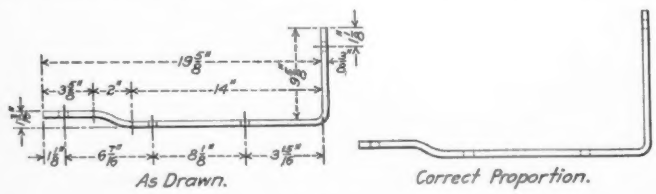


Fig. 6.

for ¾ in." gives all necessary information? It seems particularly unnecessary to mark hole *B*, and then show its elliptical projection.

Considerable trouble was caused by the drawing shown in

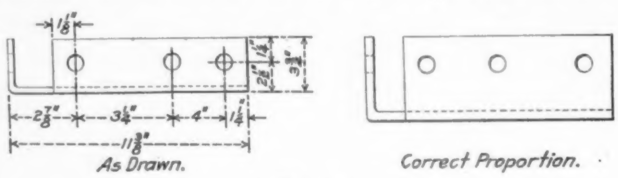


Fig. 7.

Fig. 5, as no idea of the piece could be obtained from the drawing. This drawing is particularly inconsistent, as several dimensions are lacking and must be judged from the appearance of the drawing. In case the drawing is made to scale a dimension may be omitted, but when not to scale every dimension must be shown.

Figures 6 and 7 simply show the impossibility of getting correct ideas from the drawings as originally made.

Drawings such as these are a continual source of trouble in the shop and the little saving made in the drafting room is lost over and over again.

GAINES FIREBOX ON THE ILLINOIS CENTRAL

After an experience of several months with a six-wheel switching locomotive fitted with a Gaines combustion chamber, a high degree superheater and a Ragonnet power reverse gear, the Illinois Central ordered 40 more of the same design which are now being delivered by the American Locomotive Company. A similar design of firebox was also specified on one of the last order of Mikado type locomotives built by the Baldwin Locomotive Works for this railway.

When the Lake Shore & Michigan Southern fitted a high degree superheater to a switch engine, a little over a year ago, considerable doubt was expressed as to the chances for the success of the experiment. The results, however, were even better than had been anticipated by the officials responsible for the trial and later experience on this and other roads has shown that in no service does the superheater give as great an improvement in operation or percentage saving in fuel and water as in switching. Coal savings as large as 50 per cent. have been reported in some instances. This greatly reduces, and in some cases is said to practically eliminate the smoke, due not only to less coal being fired, but also to the opportunity for more efficient work on the part of the fireman.

Reduction of the smoke from switch engines is an important feature at many yards, and particularly so at some of the yards on the Illinois Central. In an effort to make even further improvement in this particular, as well as to obtain greater economy of coal and cost of boiler maintenance, a Gaines combustion chamber was also applied to the experimental engine. This combination is reported to have been as successful as it is known to be on road engines. As a still further improvement, a power reverse gear was specified for the purpose of reducing the labor of the engineman, particularly on those engines operating in the warmer climate at the southern end of the system.

The service of the first engine in the yards on the lake front in Chicago has been very satisfactory. The yardmaster reports that it is capable of much more work than others of the usual design due to quicker action and a smaller loss of time for getting water or fuel. No difficulty has been experienced with delayed stopping after the throttle is closed, or with slow action with the reverse gear. The engine crews have equally favorable comments to make.

Outside steam pipes, arranged the same as for a superheater road engine are used. A connection is made to the superheater damper so that it is closed when the blower is put in action. This is in addition to the usual small cylinder and counterweight working in conjunction with the pressure in the steam chest and has been applied as a positive insurance that this damper is closed when the blower is open.

There is a manhole in the boiler shell under the base of the bell. This is for the inspection of the tubes and firebox and will permit the entrance of a man without removing other parts as is generally necessary when entrance is made through the steam dome.

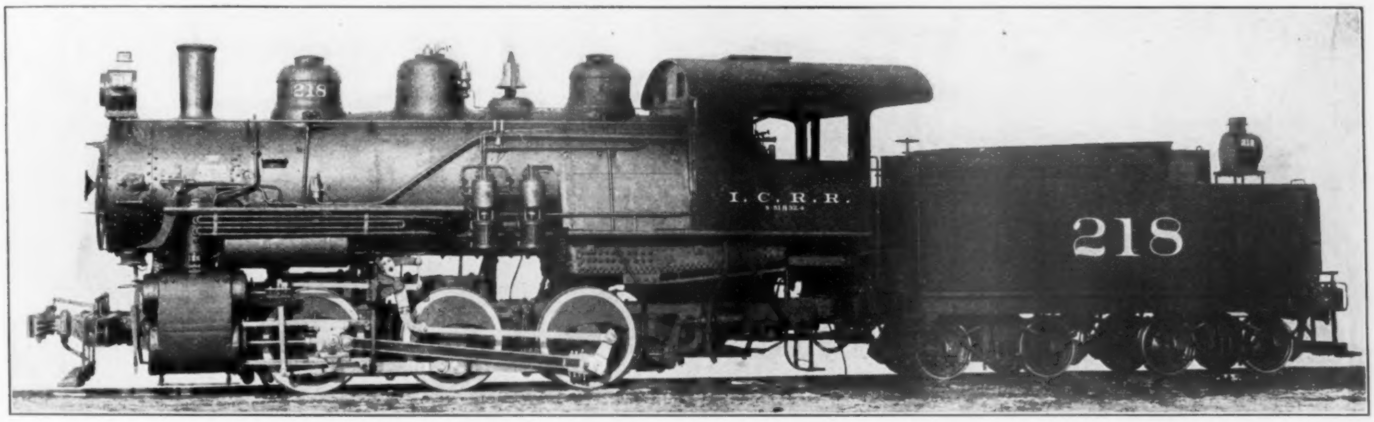
In other respects the design follows common practice for this type of locomotive when fitted with Walschaert valve gear. The features of the design are clearly shown in the illustration and the dimensions will be found in the table at the end of this article.

Mikado type locomotives have proved most satisfactory on the Illinois Central, and during the past two years 150 engines of this type have been received from the Baldwin Locomotive Works. All of these have cylinders 27 in. x 30 in., 63 in. drivers and a steam pressure of 175 lbs. The tractive effort is 51,700 lbs. A typical example was illustrated and described on page 346 of the September, 1911, issue of this journal. One of the locomotives in the last order differs from the others in that it has been fitted with a Gaines combustion chamber. This has required considerable change in the boiler but in other respects the engine is the same as the others of this class.

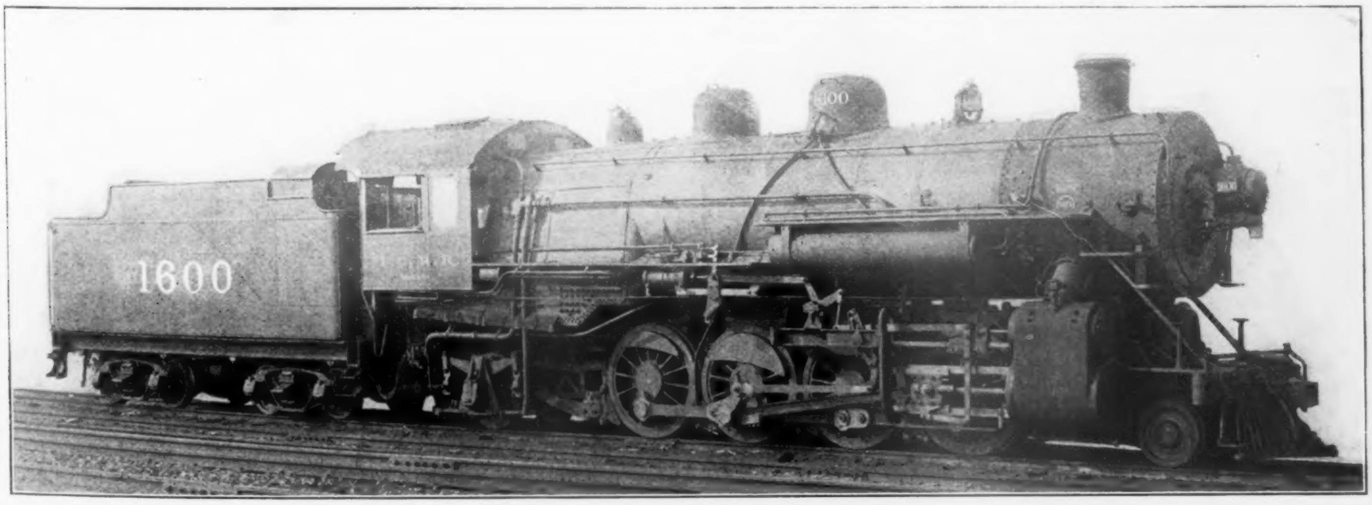
The boilers of the locomotives with the normal firebox are 82 in. in diameter at the front ring, have tubes 20 ft. 6 in. in length and a total evaporative heating surface of 4,068 sq. ft. The grate area is 70 sq. ft., and the firebox is 120⅝ in. long by 84 in. wide. On locomotive No. 1600, which is fitted with a Gaines combustion chamber, the firebox is 198 in. long by 90 in. wide and the tubes have been shortened to 18 ft. 3 in. This has resulted in a loss of 421 sq. ft. of heating surface in the tubes which is slightly offset, so far as actual area is concerned, by a gain of 19 sq. ft. in the firebox, leaving a net loss of 402 sq. ft. As a steam maker, however, it is probable that this boiler will prove even better than the others. It is known that the front 2 ft. of a 20 ft. tube is comparatively inefficient while on the contrary, a gain in firebox heating surface is of very decided value and especially when the improved combustion given by the Gaines arrangement of brick arch and air inlets is considered, there seems little doubt but that this design of boiler will have an equal or greater capacity than the others. The fact that a larger increase in the amount of firebox heating surface does not result from the much larger mud ring is explained by the practical elimination of the throat of the boiler and the raising of the grate level throughout. The depth of the firebox is about 73¼ in. at the front and 64 in. at the back and the distance from the grate level to the crown sheet at the front end of the grate is but 66 in.

The brick wall is set 36 in. from the back flue sheet and is 13 in. thick. The top of the wall is 20 in. from the crown sheet at the center. There are six air inlets discharging underneath a deflecting brick arranged as shown in one of the illustrations. The grate area of this firebox is 67.5 sq. ft. The ratio of firebox heating surface to grate area is 3.77, while on the other locomotives, in spite of the fact that they are considerably deeper, the ratio is but 3.36. The grate is of the usual finger type, rocking in four sections and with a dump grate at the rear.

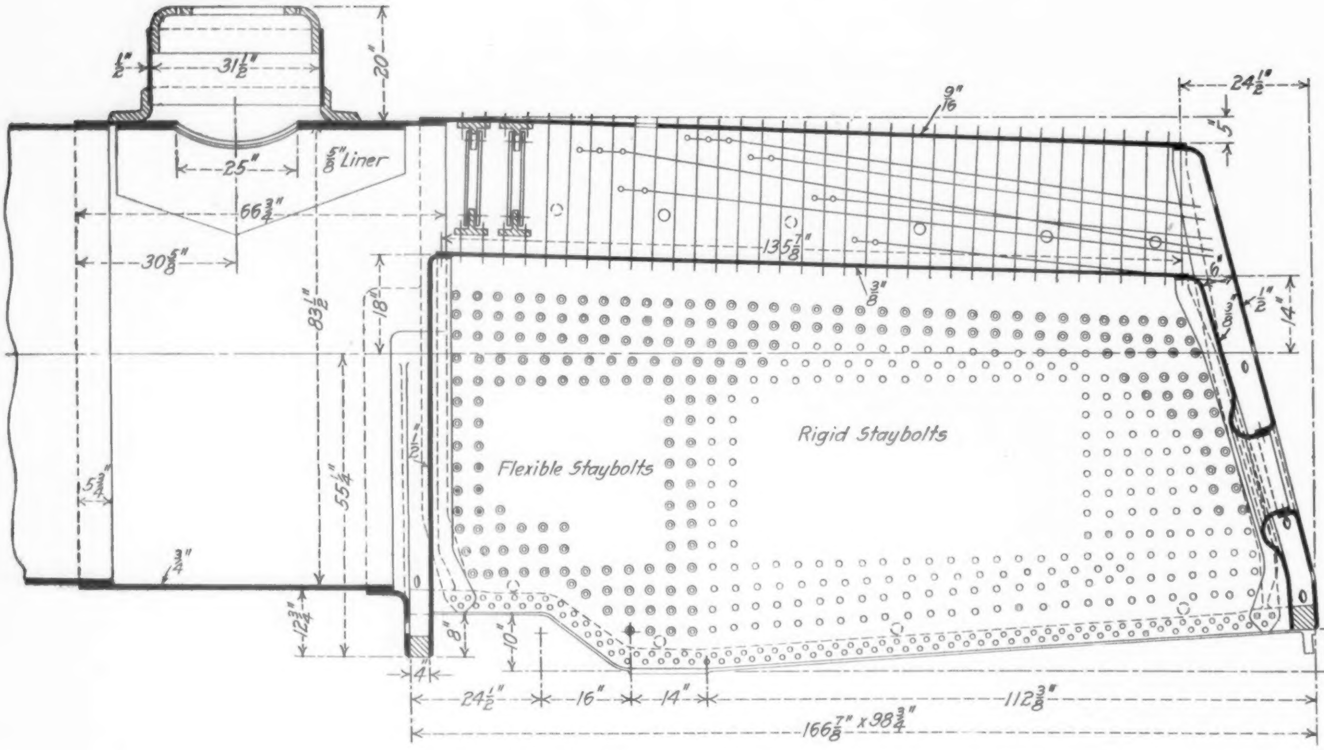
It will be seen that the advantages offered by the Gaines arrangement in connection with the location of the firebox in relation to the driving wheels have proved valuable in this case and the front mud ring is located almost directly over the rear driving axle. In order to give the necessary clearance the mud ring is inclined sharply upward on the sides, at the point of connection of the steel casting supporting the brick wall, and reaches practically the level of the bottom of the barrel. The lowest point is 8 in. below the level of the front corners. Flexible staybolts are used throughout the combustion chamber section



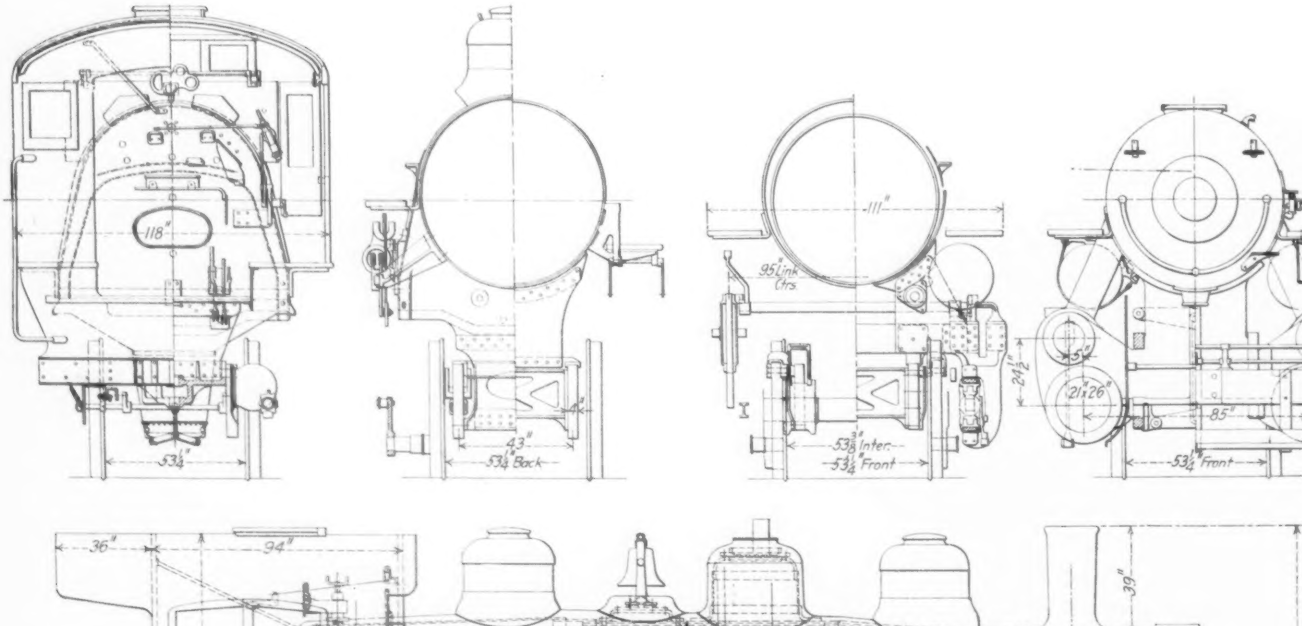
Superheater Switch Engine with Gaines Combustion Chamber; Illinois Central.



Mikado Type Superheater Locomotive with Gaines Combustion Chamber.



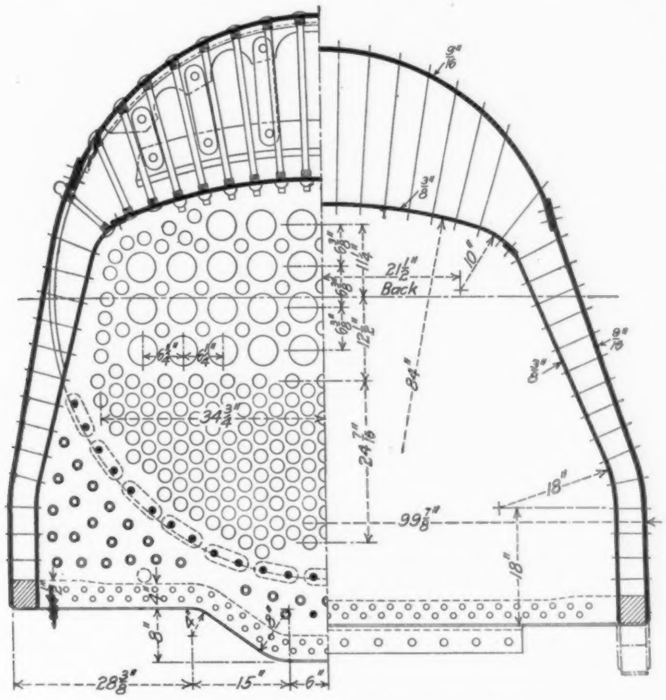
Longitudinal Section of Back End of the Boiler on the Mikado Type; Illinois Central.



Six-Wheel Switcher with Superheater, Gaines Combustion Chamber and Ragonnet Power Reverse Gear; Illinois Central.

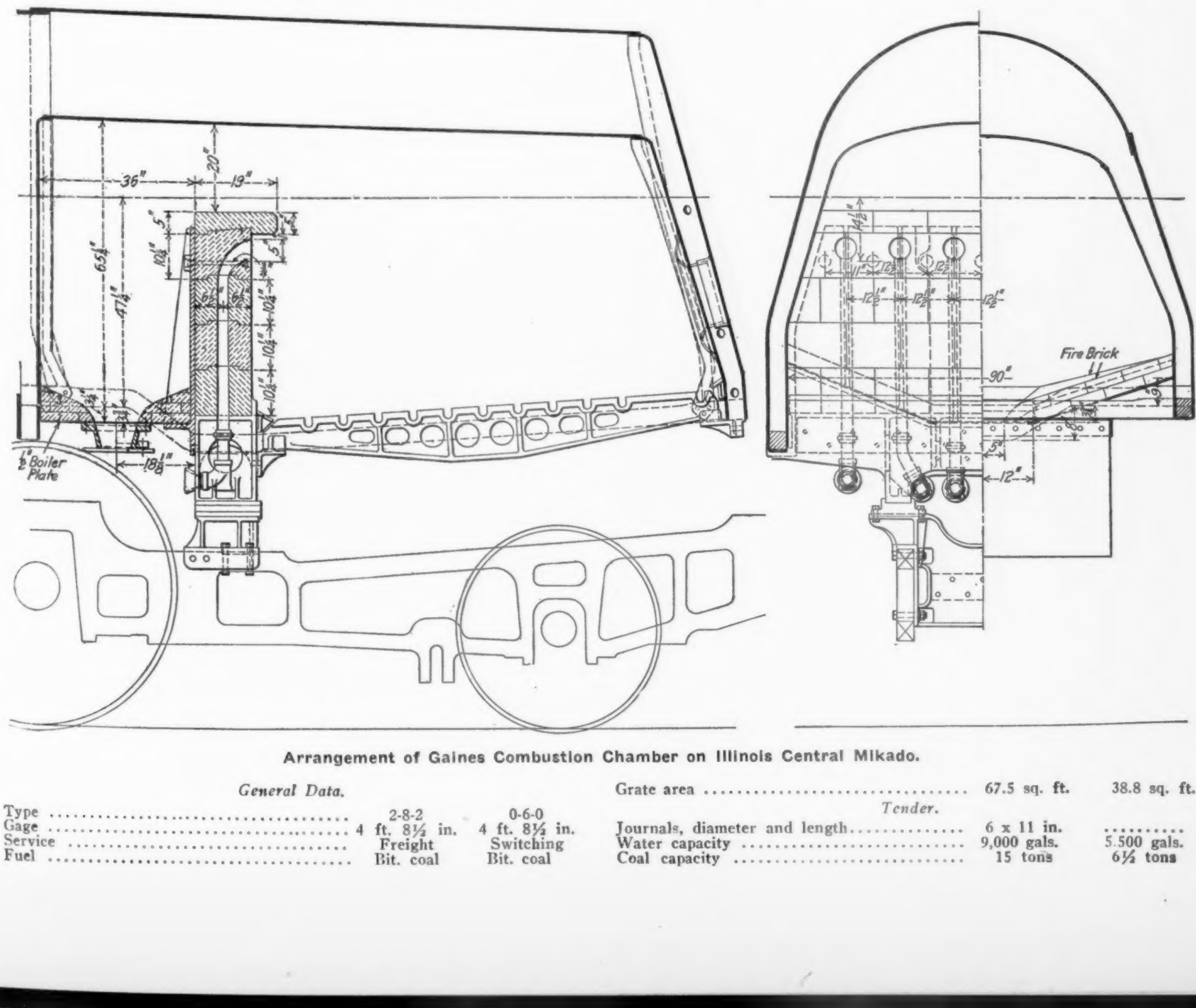
and also in the top two rows and down the back of the side sheets. The firebox is radial stayed except for the customary two rows of sling stays at the front end of the crown sheet.

These locomotives are provided with superheaters having 36



Sections Through the Firebox of the Mikado.

elements and are fitted with outside steam pipes. The general dimensions, weights and ratios are given in the following table:



Arrangement of Gaines Combustion Chamber on Illinois Central Mikado.

General Data.		
Type	2-8-2	0-6-0
Gage	4 ft. 8½ in.	4 ft. 8½ in.
Service	Freight	Switching
Fuel	Bit. coal	Bit. coal
Tractive effort	51,700 lbs.	32,450 lbs.
Weight in working order	280,000 lbs.	166,000 lbs.
Weight on drivers	217,000 lbs.	166,000 lbs.
Weight on leading truck	28,000 lbs.	....
Weight on trailing truck	35,000 lbs.	....
Weight of engine and tender in working order	450,000 lbs.	....
Wheel base, driving	16 ft. 6 in.	11 ft. 8 in.
Wheel base, total	35 ft. 2 in.	11 ft. 8 in.
Wheel base, engine and tender	65 ft. 7 in.	....
Ratios.		
Weight on drivers ÷ tractive effort	4.20	5.12
Total weight ÷ tractive effort	5.42	5.12
Tractive effort × diam. drivers ÷ heating surface	880.00	1,061.00
Total heating surface ÷ grate area	54.20	40.20
Firebox heating surface ÷ total heating surface, per cent	6.93	9.70
Weight on drivers ÷ total heating surface	59.10	106.50
Total weight ÷ total heating surface	76.20	106.50
Volume both cylinders, cu. ft	20.00	10.40
Total heating surface ÷ vol. cylinders	183.30	149.60
Grate area ÷ vol. cylinders	3.38	3.74
Cylinders.		
Kind	Simple	Simple
Diameter and stroke, in	27 x 30 in.	21 x 26 in.
Valves.		
Kind	Piston	Piston
Diameter	15 in.	....
Wheels.		
Driving, diameter over tires	63 in.	51 in.
Driving, thickness of tires	3½ in.	....
Driving journals, diameter and length	11 x 12 in.	9 x 12 in.
Engine truck wheels, diameter	30½ in.	....
Engine truck journals	6 x 10 in.	....
Trailing truck wheels, diameter	45 in.	....
Trailing truck journals	8 x 14 in.	....
Boiler.		
Style	Straight	E. W. T.
Working pressure	175 lbs.	170 lbs.
Outside diameter of first ring	82 in.	63 in.
Firebox, length and width	158 x 90 in.	109⅝ x 78 in.
Firebox plates, thickness	⅜ & ½ in.	....
Firebox, water space	4 in.	....
Tubes, number and outside diameter	262—2 in.	151—2 in.
Flues, number and outside diameter	36—5⅜ in.	19—5½ in.
Tubes and flues, length	18 ft. 3 in.	13 ft. 4 in.
Heating surface, tubes	3,412 sq. ft.	1,409 sq. ft.
Heating surface, firebox	254 sq. ft.	150.5 sq. ft.
Heating surface, total	3,666 sq. ft.	1,559.5 sq. ft.
Superheater heating surface	752 sq. ft.	266.6 sq. ft.
Grate area	67.5 sq. ft.	38.8 sq. ft.
Tender.		
Journals, diameter and length	6 x 11 in.	....
Water capacity	9,000 gals.	5,500 gals.
Coal capacity	15 tons	6½ tons

OIL AND GREASE CUPS FOR RODS

BY ROBERT C. MORTON.

Grease and oil cups, especially those on the main and side rods, are small locomotive details that give an excellent return from careful study to discover the best design. On a road having more than 2000 locomotives, close attention was given to this feature and, after a period of development, a design which appears to be practically perfect is now being used.

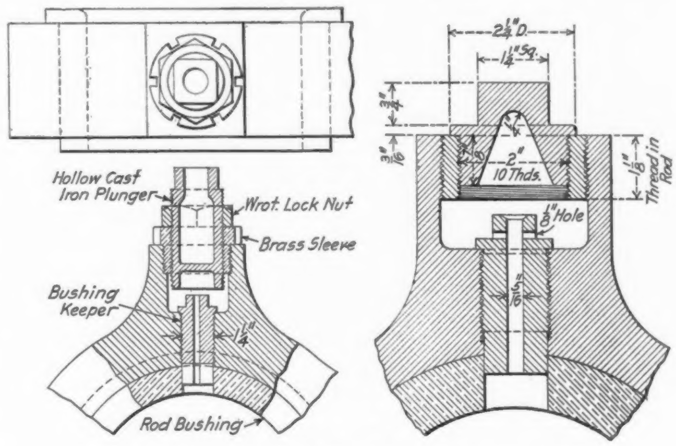
Originally detachable or independent oil cups of various designs, usually, however, made of brass, were used on the rods, but a number of years ago this road, together with practically all others, started using the solid cup formed as an integral part of the rod. At first these were made round in imitation of the detachable cups, but later the rectangular design was substituted. One of the illustrations shows a section of this type of cup arranged for using grease, the design shown being one of the first to be tried. Inasmuch as the plunger is frequently removed and reapplied and its normal use soon wears the threads enough to give a very loose fit it is necessary to use a sleeve to protect the threads in the solid oil cup. This sleeve was first made of brass with a hexagon shaped top. This was later changed to the spanner nut type, shown in the illustration, to prevent theft or easy removal with an ordinary wrench. At the bottom of the cup is a stud bolt or rod bushing keeper which secures the rod bushing at the top and is drilled for feeding the oil or grease to the pin. It has been found that the most suitable thread, both for these bolts and for the cap where it passes through the sleeve, is ten threads per inch.

A brass sleeve arranged as shown weighs about 1½ lbs. and costs about 23 cents for material and labor, and while it was intended that the sleeve should not be removed except when the locomotive came in the shop for general repairs, it developed that they frequently disappeared, and to overcome this a steel or wrought iron bushing without wrench fit was substituted. This has completely removed the difficulty from loss by theft and at the same time has reduced the cost of these bushings from 23 cents to 10 cents each.

The rod with this type of sleeve and the present arrangement of cap and stud is also illustrated. The sleeves are forged in the blacksmith shop and are threaded with a slight taper on the outside. They are inserted with a stud nut and are screwed in as tightly as possible and can be considered part of the solid cup. They are removed only when it is found that the wear is sufficient to necessitate the application of a new one. By means of these sleeves or bushings, a standard type and size of cap or plunger may be used on all the cups.

While this type of bushing together with the stud bolt illustrated in connection with it gave a cup body that was thoroughly satisfactory, considerable difficulty was experienced in finding the best type of cap and grease plunger. After a trial of various combinations of grease and oil, the method of lubrication on this road has finally settled down to the use of grease on the main pins and oil on all others. The arrangement of the cups for oil is, of course, comparatively simple, but considerable trouble was found in getting the proper cap or plunger for grease. At first a hollow cast iron plunger 2¼ in. in diameter was used with a lock nut. This arrangement is shown in the first illustration. A small wrought iron plug was then tried as it was thought too much grease was wasted by the larger size. This, however, was soon discarded and return was made to the larger size wherever possible. Malleable iron plugs were next offered and a design having a teat on the bottom which engaged in the grease and prevented the plug from becoming unscrewed was tried. With this arrangement no lock nut was needed. Finally, however, the grease plunger was entirely discarded and a grease cap was adopted, as it was found that if the cups were properly filled and the caps were screwed down tight enough to start the grease feeding, it would continue to feed in sufficient quantities to insure the proper lubrication of the journal. This cap, as it is now used, is shown in the second illustration. The oil cup cap is identical with the one used for grease with the exception that it is drilled and countersunk through the top. The oil cups are filled with curled hair and wool waste, which prevents the oil holes from becoming clogged and acts as a strainer.

These grease and oil cup caps are drop forged and cost about 7½ cents a piece, completely finished. There are only three styles of caps used for the entire locomotive crank pin equipment, and these are all made from the same drop forging. Of these, two are identical except that one is drilled for oil while the other is used for grease. The third type is a smaller size.



Old and New Types of Grease Cups on Main Rods.

When independent cups have to be used, a design of malleable iron cup is used, which takes the same cap as the solid cup. These cups do not have the wrought iron sleeves. They are held to the rods by a collar stud and also have a ¼-in. dowel pin driven in the bottom of the cup which enters a hole in the rod and prevents the cup from turning.

This arrangement for rod lubrication has now been in use for some time and appears to be thoroughly satisfactory. The number of parts required for renewals are very few. A minimum amount of capital is tied up in the equipment and the arrangement throughout appears to be thoroughly durable and efficient.

Record for Straightaway Flight.—Maurice Prevost, a French aviator, on June 19, flew 217 miles at the rate of 117 miles an hour. This was a straightaway flight. The previous record made by Prevost was made on a circular course.

Hours of Labor in New York.—Chapter 462 of the Laws of New York, passed this year, makes 10 hours' labor within 12 consecutive hours a legal day's labor in the operation of railroads and street railroads, except where the mileage system of [paying men engaged in] running trains is in operation. This law applies to all roads 30 miles long or longer.

Early Rapid Transit.—The Camden & Amboy Railroad is, we learn, partly completed and in use. This road will probably be the most traveled in this country. Passengers who leave Philadelphia at half-past six in the morning may dine in New York at 4 p. m., as they are landed at half-past three o'clock. The time is not far distant when six hours will be ample time to perform the journey.—From the *American Railroad Journal*, October 6, 1832.

Warning for Railway Trains.—A pressure tube anemometer has been placed at an exposed station of the West & South Clare Railway, Ireland, to give notice of the terrific ocean gales which sometimes derail trains. A special electrical signaling device has been added by the British meteorological office and this transmits an alarm when the wind reaches 65 miles an hour, and another if 85 miles is attained. Trains are ballasted after the first signal, and all traffic is suspended on the second alarm. —*Newark News.*

SHOP PRACTICE

INSTALLATION AND MAINTENANCE OF ELECTRIC HEADLIGHT EQUIPMENT

BY V. T. KROPIDLOWSKI,

I.

The enactments of the legislatures of a number of states requiring that railroads operating within their borders provide their locomotives with headlights of a certain candle power or intensity practically compel the use of the electric headlight. This accessory of the locomotive is comparatively new on some of the western roads, or at least on the greater number of their divisions, and especially to those to whom the task of installing and maintenance is intrusted; moreover the time allowed for the equipment of all locomotives has been so short that little consideration could be given to the selection of a suitable system of wiring and details of sufficient flexibility to permit its application to all classes of locomotives and headlight equipment.

The electric headlight equipment is a complete power plant in itself and demands the attention of men trained along that line, but its care is frequently intrusted to men who do not thoroughly understand it, with the result that much unnecessary expense is incurred, the apparatus is damaged and the blame laid to imperfections in construction. In order to make the electric headlight a successful and economical addition to the locomotive, it must be given the attention of trained men; the work of installation and maintenance should be placed in the hands of a capable man who should select intelligent and preferably young men as his assistants at various points on the system, instruct them in the work and retain them expressly for it. It would also be a move in the right direction to install an electric headlight in the air brake instruction car and give lectures on its care and operation similar to those given on the subject of air brakes.

It is intended in this article, which is the first of a series dealing with the installation and care of electric headlight equipment, to describe a method of wiring which has flexibility as one of its main features and which can be applied with any existing type of electric headlight equipment. By referring to the wiring diagram, Fig. 1, it will be seen that only three wires are required from the switch in the locomotive cab to the lamp, two of which should be, throughout their entire length, of sufficient capacity to carry the whole load, and one (number three) should be, from the negative lead of the generator to the lamp, of a capacity to carry the current necessary for the incandescent lamps at the front end of the locomotive. By tracing out the connections it will be found that when the switch in the cab is thrown into contact *3*, the current flows from the positive lead of the dynamo through wire *1* and the arc lamp, returning to the negative lead of the dynamo by way of wire *2*, through the switch to contact *3* and wire *3*. When the switch is thrown into contact *1*, the circuit is broken, the arc lamp then goes out and the pilot lamp lights, receiving current from the dynamo through wire *1*, contact *1* and wire *2*, and returning it over the wire *3* to the dynamo; the large arrows represent the current of the arc lamp and the small ones that of the pilot lamp. The number lamp burns continuously, as it is connected across wires *1* and *3*, which lead directly from the generator. The classification lamps are not shown, as some roads are not in favor of electrifying them because of the possibility of the enginemen forgetting to put in the right markers when they do not have to go to the lamps to light them. The writer believes, however, that this difficulty can be overcome.

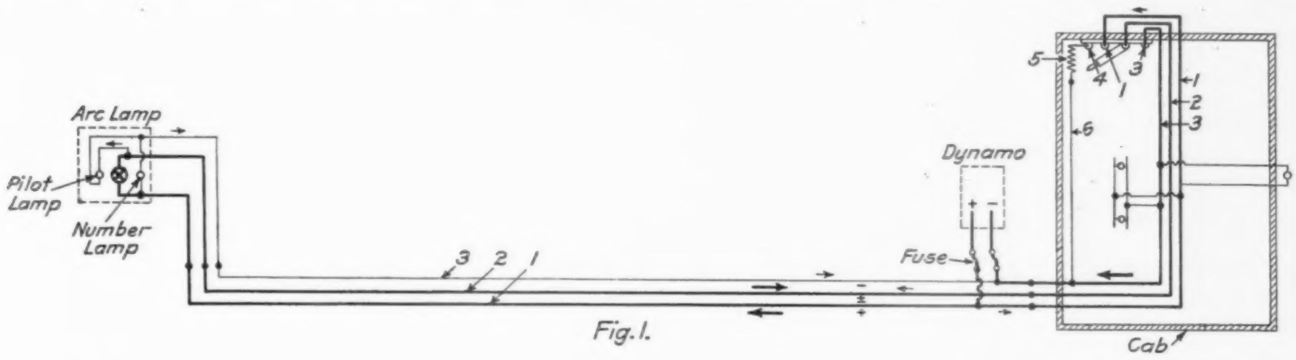


Fig. 1.

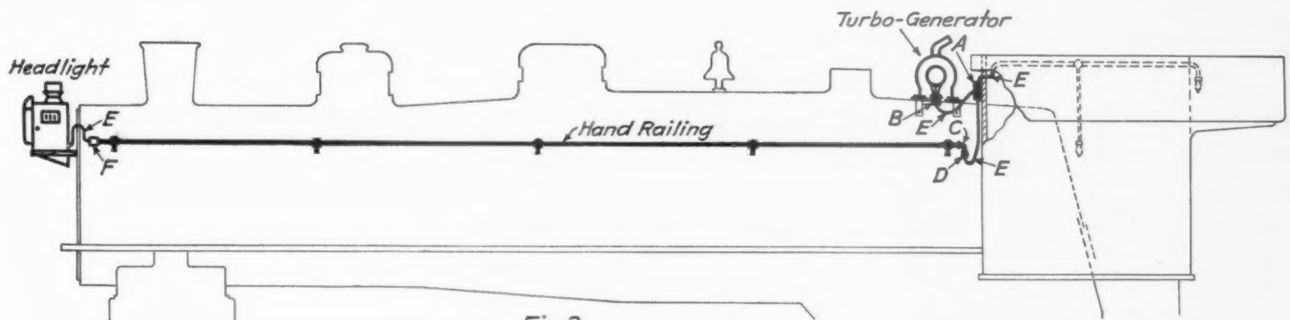


Fig. 2.

The arrangement consisting of the extra contact *4*, attached to the switch, the resistance *5*, and the wire *6*, is employed only in connection with a series wound generator, such as the American, manufactured by the Remy Electric Company, but when a compound wound generator is used, such as the Pyle or

Schroeder, the resistance *5* must be removed or the connections broken, leaving a blank space between the contact *4* and the wire *6*; this is important as with the circuit unbroken in that branch it would cause the generator to develop too high a voltage and possibly burn out the incandescent lamps or the fuses, if they were used.

Fig. 2 shows the method employed to conceal the wiring, and the fittings required in connection with it. A weatherproof, cast iron junction box *A*, in which is fastened a triple-to-double plug cut-out, is fastened to the front of the cab. The leads from the dynamo are led into a type "F" conduit as shown at *B*, and through a Greenfield flexible steel conduit *E* to the junction box, which they enter from the side, and are connected to the two terminals of the cut-out which make connection with the plug fuses. The main circuit wires are run through the hand rail of the locomotive and at the cab end a Greenfield combination coupling, *C* and *D*, is used to connect a flexible steel conduit *E* to the railing, the flexible conduit being of sufficient length to reach to the junction box *A*, entering it from the bottom, and the circuit wires are then clamped to the cut-out block. The main circuit wires are continued from the junction box *A* into the cab and to the switch. The wiring in the cab can be open and cleated to the ceiling of the cab, but in the long run it pays to have it in a flexible steel conduit, as in case the wiring needs to be removed for any reason, it is much simpler to unfasten a few conduit fasteners and remove it in a unit than to have a tangled group of loose wires.

At the head end of the locomotive a junction box *F* is attached to the end of the hand rail and the main circuit wires lead into it and are connected to a triple pole cut-out. The circuit is continued to the headlight in a flexible steel conduit *E*, which is led into the lamp and connected to the proper binding posts.

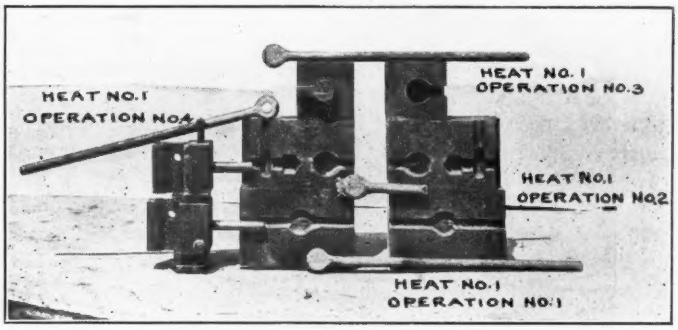
Most of the later wiring is concealed in a separate conduit, the reason given being that it prevents the possibility of injury to anyone walking on the running board and holding to the hand rail. It is not believed that it is dangerous to use the hand rail as a conduit, nor that it increases the difficulty of dismantling the locomotive. The conditions are unlike those in a power plant; the potential carried is so low that even though a ground were purposely established, with the return circuit constituting a man grasping the hand rail and his bare feet placed on any metal part of the locomotive, it is doubtful whether the low electromotive force of thirty volts could cause any current to flow through the painted hand rail. Moreover, the dynamo is grounded to the boiler and, consequently, to every metal part of the locomotive. Supposing a ground did develop in the winding of the generator; one ground is of no consequence and two grounds, one on each wire of opposite polarity, are necessary to complete a path for the current. Should another ground develop by the insulation wearing off one of the wires in the hand rail, there would be no more shock than one would experience by submerging a piece of pipe, with both ends open, in a small stream of water. As to the wiring strung through the hand rail hindering its removal, the hand rail is seldom removed between shoppings, and at those times, if the proper fittings are selected, it will take very little longer to disconnect the wires in the junction box in the cab, unfasten the fitting from the cab end of the hand rail, and disconnect the wires in the junction box at the front end than it does to remove the finishing knobs on the ends of the rail.

EXPERIMENTAL RAILROAD.—The Railroad Company of this city (Raleigh, N. C.) expect to have their road between the Capitol Square and the Stone Quarry completed by New Year's Day if not prevented by inclement weather, and a handsome car upon it for the accommodation of such ladies and gentlemen as may desire to take the exercise of a railroad airing.—From a despatch dated December 28, 1832, to the *American Railroad Journal.*

THE MANUFACTURE OF BRAKE BEAM HANGERS

BY ISAIAH S. WESTLEY,
Erecting Foreman, Philadelphia & Reading, Reading, Pa.

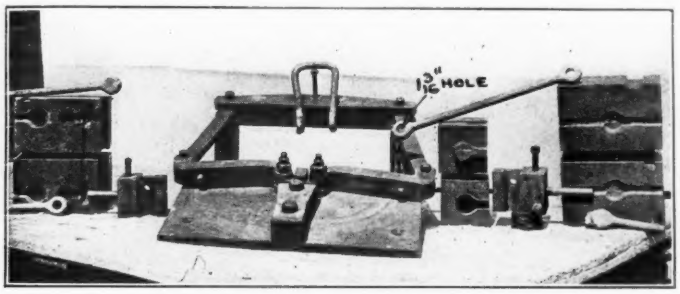
All the hammer and forging machine work for the Philadelphia & Reading is done at the Reading, Pa., shops and it has been the aim to keep the number of operations and heats down



Operations in Making Brake Beam Hangers at the Reading Shops.

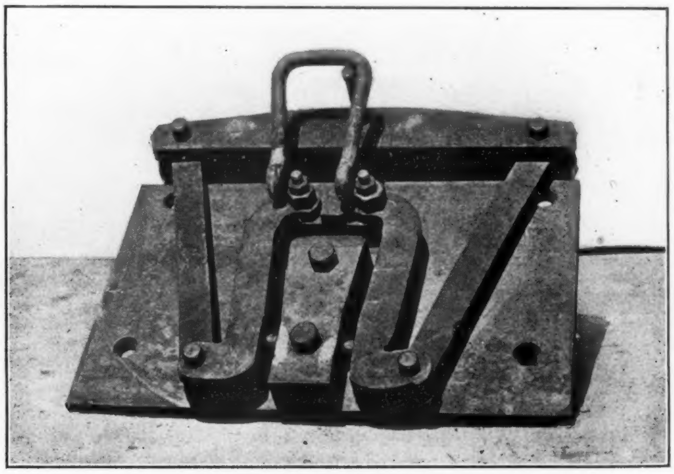
to the lowest possible number in order to lower the cost of production and increase the output.

The method of manufacturing brake beam hangers is shown in the illustrations. After the stock is cut to the required length and the first heat taken, the following is the order of



Former and Dies for Making Brake Beam Hangers.

the operations: Operation 1, heat 1, upsetting end; operation 2, heat 1, squeezing in forming die; operation 3, heat 1, trimming fin in trimming die; operation 4, heat 1, punching hole for hanger pin. One end of the hanger is then complete and heat



Former for Brake Beam Hangers, in Closed Position.

2 with the same operations completes the other end; the hanger is then ready for the forming machine. The final operation of forming the hanger in the die is made with the third heat;

the forming machine is of a hinge type, operated by a 14 in. x 12 in. brake cylinder. It is controlled by a single valve and is therefore easy to operate. The dowel pins engage with the holes in the hanger; this does away with the necessity for centering and insures the holes being in line and the hanger the correct length. With four men, two working on an Ajax forging machine and two on the forming machine, the total output for ten hours is 650 hangers; it can readily be seen that a considerable saving in fuel will result from reducing the number of heats.

SHOP KINKS

BY W. H. WOLFGANG,
Draftsman, Wheeling & Lake Erie, Toledo, Ohio.

SAFETY GATES.

In a great many shops where railway tracks pass very close to the doors and corners of the buildings, accidents may be easily eliminated by the use of gates, such as shown in Fig. 1. These can only be used where no regular traffic is carried on, and they

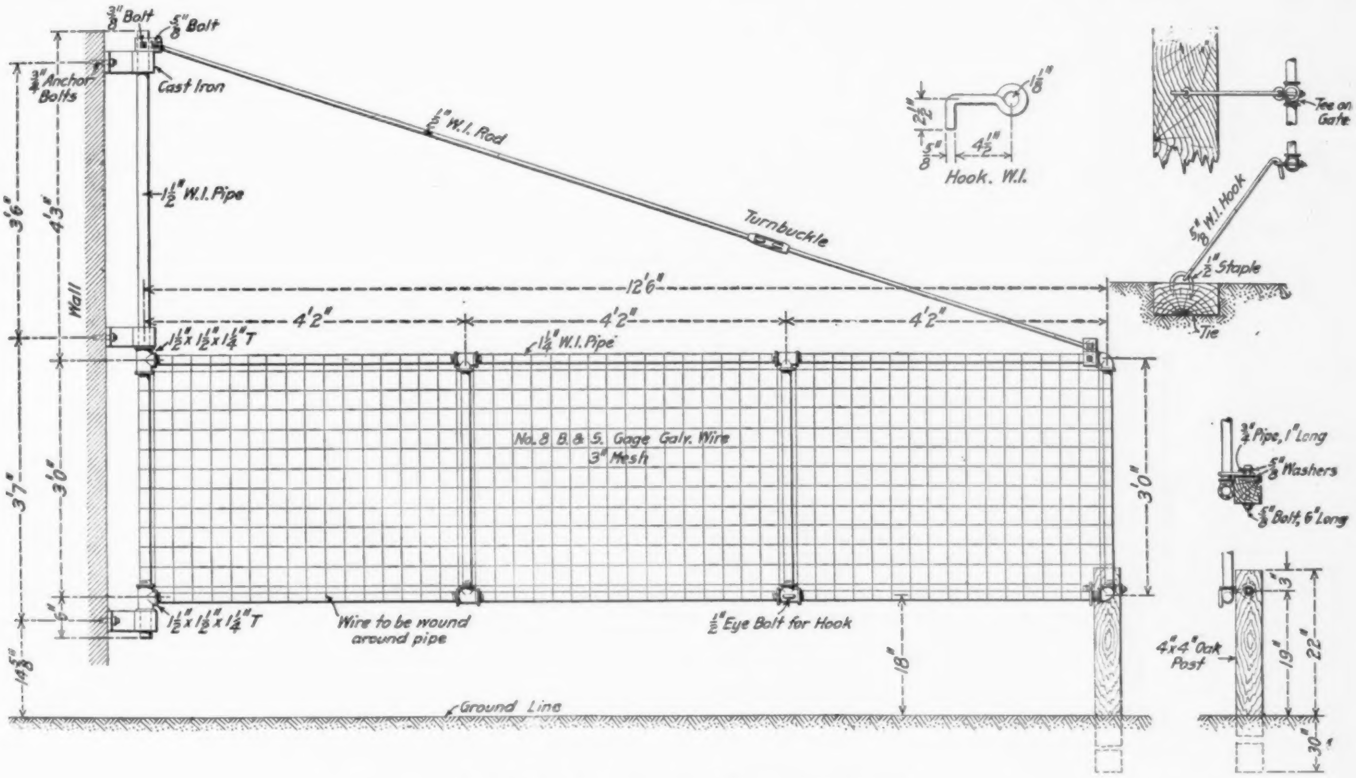


Fig. 1—Safety Gates for Use in Shop Yards.

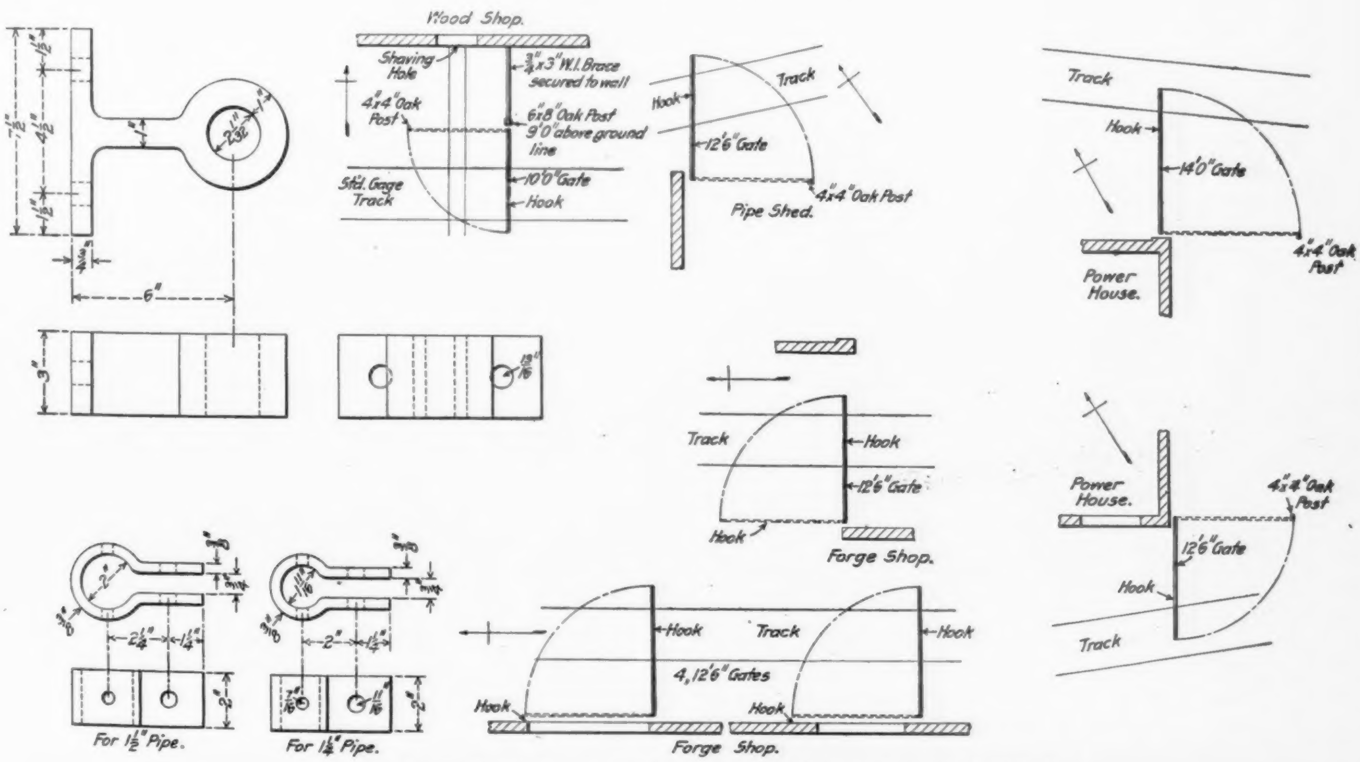


Fig. 2—Various Methods of Locating Safety Gates to Prevent Accidents.

are operated as follows: When a train is shifting past the doors or corners of the buildings, the gates are swung back off the track and secured so as to close the passageway. The different methods by which the gates may be applied are shown in Fig. 2. The gate post is made from a 1½ in. standard pipe, which revolves in three cast iron brackets as shown in Fig. 2. These are bolted to the walls or posts as may be convenient. The gate is made from 1¼ in. standard pipe and fittings. The length of the gate can be made to suit. Galvanized iron wire netting of 3 in. mesh and No. 8 Brown & Sharp gage is secured to the 1¼ in. pipe by wrapping the strands of wire around the pipe. The method of locking the gate when swung across the tracks, and the method of securing it when swung across the passageway is shown in Fig. 1.

BALL BEARING JIB CRANE FOR GENERAL USE.

Usually jib cranes that are not ball bearing are hard to swing when carrying a load, especially when it is applied near the mast. The crane shown in Fig. 3 is provided with ball bearings and was designed to carry a load of 3 tons. As one man can easily swing the loaded crane, it will be found that the additional cost will soon be paid for by the time and labor saved. A 12-in., 31.5-lb. I-beam is used for the mast, and is reinforced by two 1-in. truss rods as shown. The boom is an 8-in., 18-lb., I-beam riveted to the mast by two web angles and supported by two 1¼-in. guy rods. Ball bearings 1½ in. in diameter are used at the bottom of the crane and 7/16-in. steel roller bearings at the top. The top support can be made to suit the conditions of the buildings.

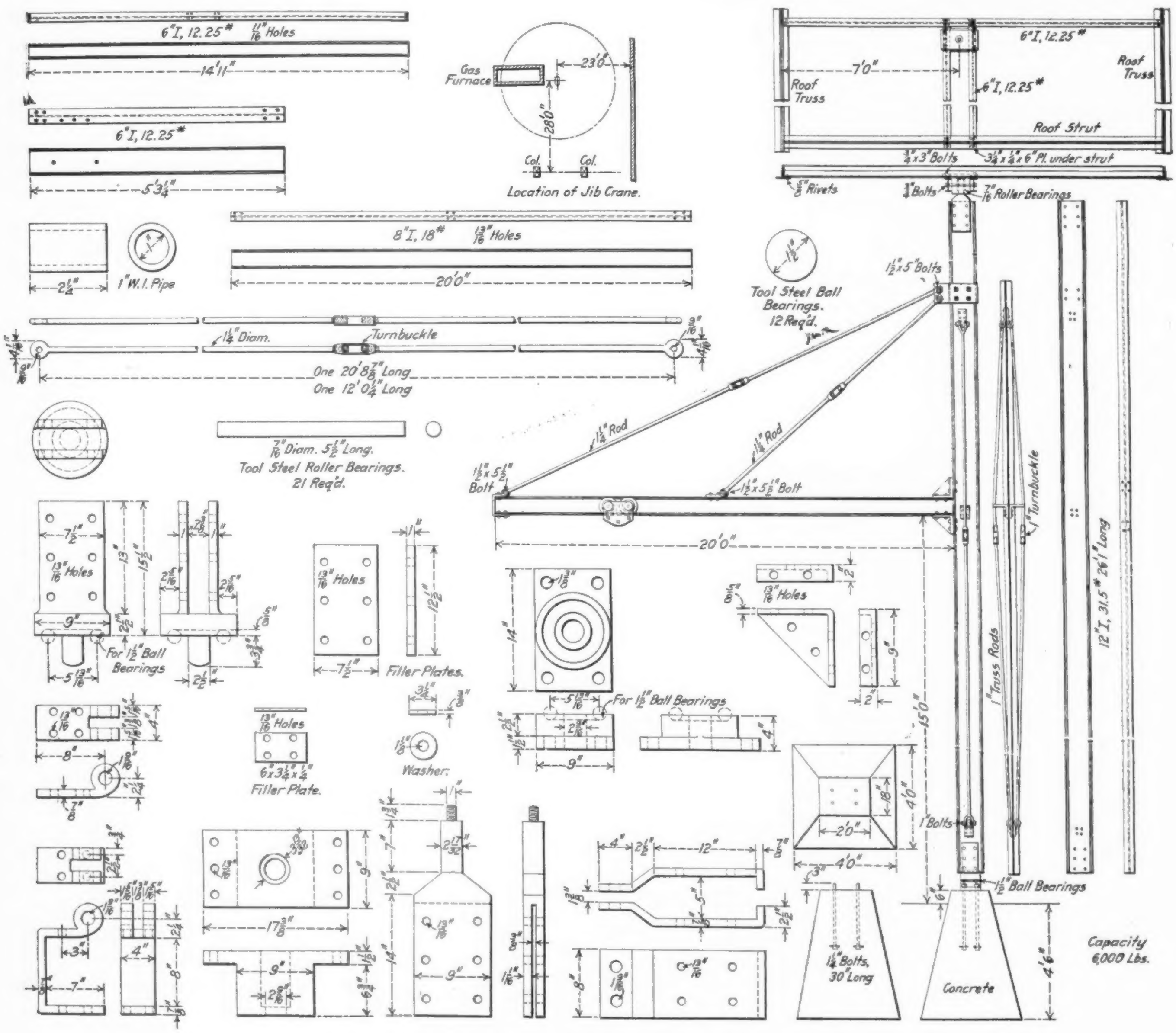


Fig. 3—Ball-Bearing Jib Crane of Three Tons' Capacity.

MACHINERY BELT RECORD.

The chart shown in Fig. 4 has been found to be a good scheme for keeping an accurate record of the belting on machinery. These diagrams can be made for various types of machines and each belt and pulley marked as shown. The belt man can keep the records up to date so that whenever a belt breaks he can readily refer to his diagrams for its length and size and can immediately set about getting another to replace it. In this way he will save both his own time and that of the workmen. The speed and direction of rotation of the pulleys is also shown so that if it is desired to change the speed of any machine a study of the conditions may be made directly from the chart. The illustration shows the belting record for a 4½-in. surfacer, and is typical of the records for other machines.

REINFORCING A STEEL BUILDING COLUMN FOR A 2,500 LB. CAPACITY JIB CRANE.

The reinforcement shown in Fig. 5 was applied to a roof supporting column to prevent it buckling when a 2,500 lb. jib crane

was applied to it. A ⅜ in. x 12 in. wrought iron plate was riveted the full length on the face of the column, and another shorter ⅜ in. x 12 in. plate was riveted on top of this plate.

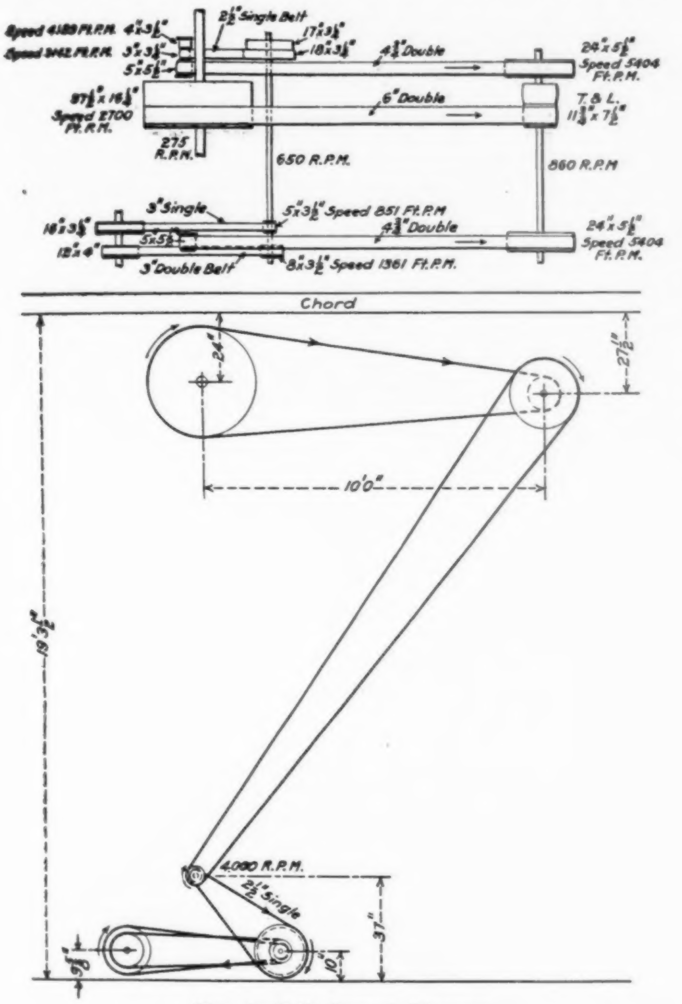


Fig. 4—Belt Record Diagram.

Some 2½ in. x 2½ in. x ¼ in. angles were riveted on the back of the plates as shown. Three sets of ½ in. x 6 in. wrought iron braces were riveted to the plates and the column flange, and

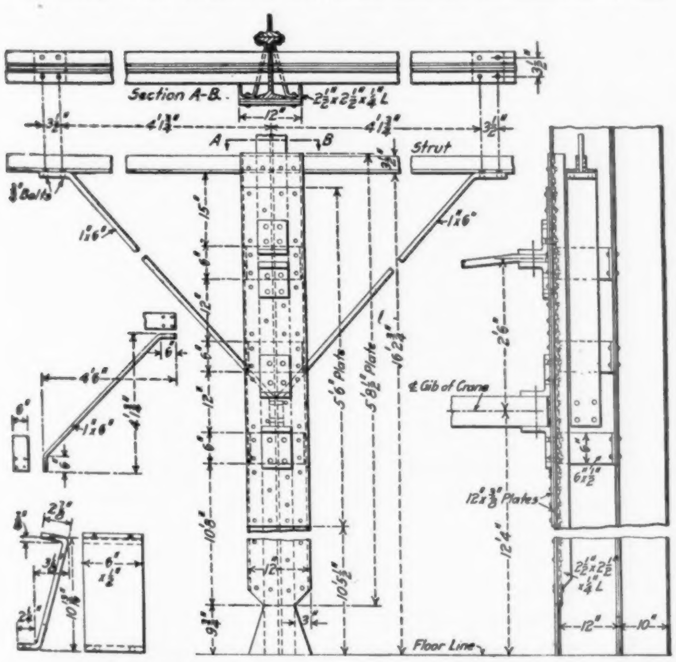


Fig. 5—Roof Column Reinforced to Provide for Jib Crane.

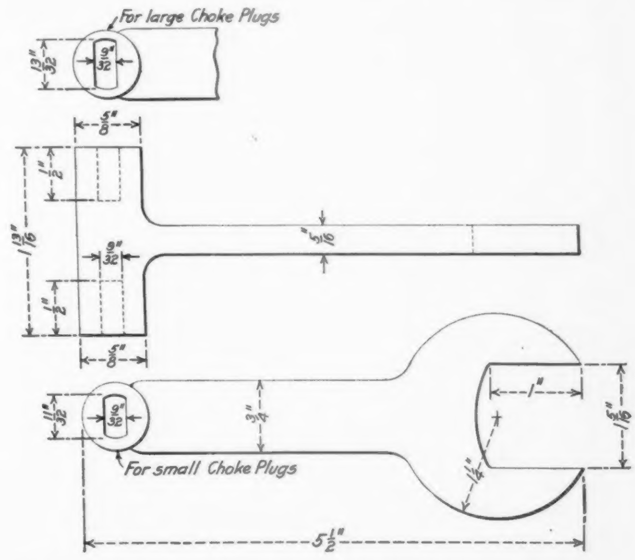
two 1 in. x 6 in. wrought iron braces were riveted to the column and roof strut. The brackets were then bolted to the column, as shown. The crane boom was secured to the lower brackets and the tension rod to the upper ones.

WRENCH FOR REMOVING LUBRICATOR CHOKE PLUGS

BY F. W. BENTLEY, JR.,
Butler Shops, Chicago & North Western, Milwaukee, Wis.

The greater percentage of lubricator troubles is caused by the obstruction of the choked end of the reducing plugs. It is an easy task for the engineer or shop man to uncouple the delivery nut and remove the plug if the lubricator is accessible for the application of a common monkey wrench and the squared end of the choke plug has not been rounded by other applications of the wrench; however, in many instances, owing to the cramped location of the lubricator and to the condition of the end of the plug it is almost impossible to remove it, and failures are often the result.

The illustration shows a wrench that can be easily forged



Wrench for Removing the Choke Plugs from Lubricators.

and which it is believed will eliminate all difficulties in connection with the hurried cleaning of choke plugs. The delivery nuts on all Nathan locomotive lubricators are of the same size, and are easily uncoupled by the forked end of the wrench. The two sizes of reducing plugs used in this lubricator are easily removed by the socket on the other end of the wrench no matter how badly they are rounded at the ends, or twisted. One of these wrenches can be kept in the roundhouse office where it is promptly available when failures of this nature are discovered over the "going out" pit, and one can be easily carried in the engineman's tool box.

Hot Air Blast.—It is stated that the weekly consumption of coals at the Clyde Iron Works has been reduced by the adoption of the heated blast from 1,800 tons to 600 tons, while, at the same time, a greater quantity of iron has been manufactured.—*American Railroad Journal,* February 9, 1833.

Railroad News.—The steam car South Carolina arrived at Charleston at half-past seven p. m. on the 15th from Branchville, 62½ miles, in 7 hrs. 15 min., all stoppages included. Eighteen passengers; cargo 70 bales of cotton. Stopped at Summerville 30 min. to discharge freight cars.—*American Railroad Journal,* January 5, 1833.

POWER REQUIRED FOR PUNCHING

BY L. R. POMEROY.

In punching a hole in a plate, the total area of shearing is that of a curved surface—of a cylinder of a length equal to the thickness of the plate (t) and a diameter equal to the diameter of the hole (d). Assuming a plate of 60,000 lbs. tensile strength, the resistance due to shearing is

$$\pi \times t \times d \times 60{,}000 \quad \text{......... 1}$$

It has been found, experimentally, that in punching plates, of the tensile strength given, when the punch has passed one-third the distance through, the material is all sheared off.

Assuming the resistance to be constant during the process of punching, the work in foot pounds necessary to punch one hole equals the resistance in pounds per square inch times 1/3 the thickness of the plate, divided by 12, or as given above,

$$t \times \frac{1}{12} \times \frac{1}{3} \quad \text{......... 2}$$

This value multiplied by the number of holes punched a minute and divided by 33,000 gives the horsepower for the punching alone. To this must be added the friction of the machine and the efficiency of driving.

Let S = Tensile strength of the plate = 60,000 lbs.
d = Diameter of the hole.
t = Thickness of the plate.
E = Effective depth of entrance of punch to shear the plate = 1/3.
N = Number of holes punched a minute.
C = Efficiency of punch (assumed to be 75 per cent.).
C_m = Efficiency of motor or drive (assumed to be 80 per cent.).

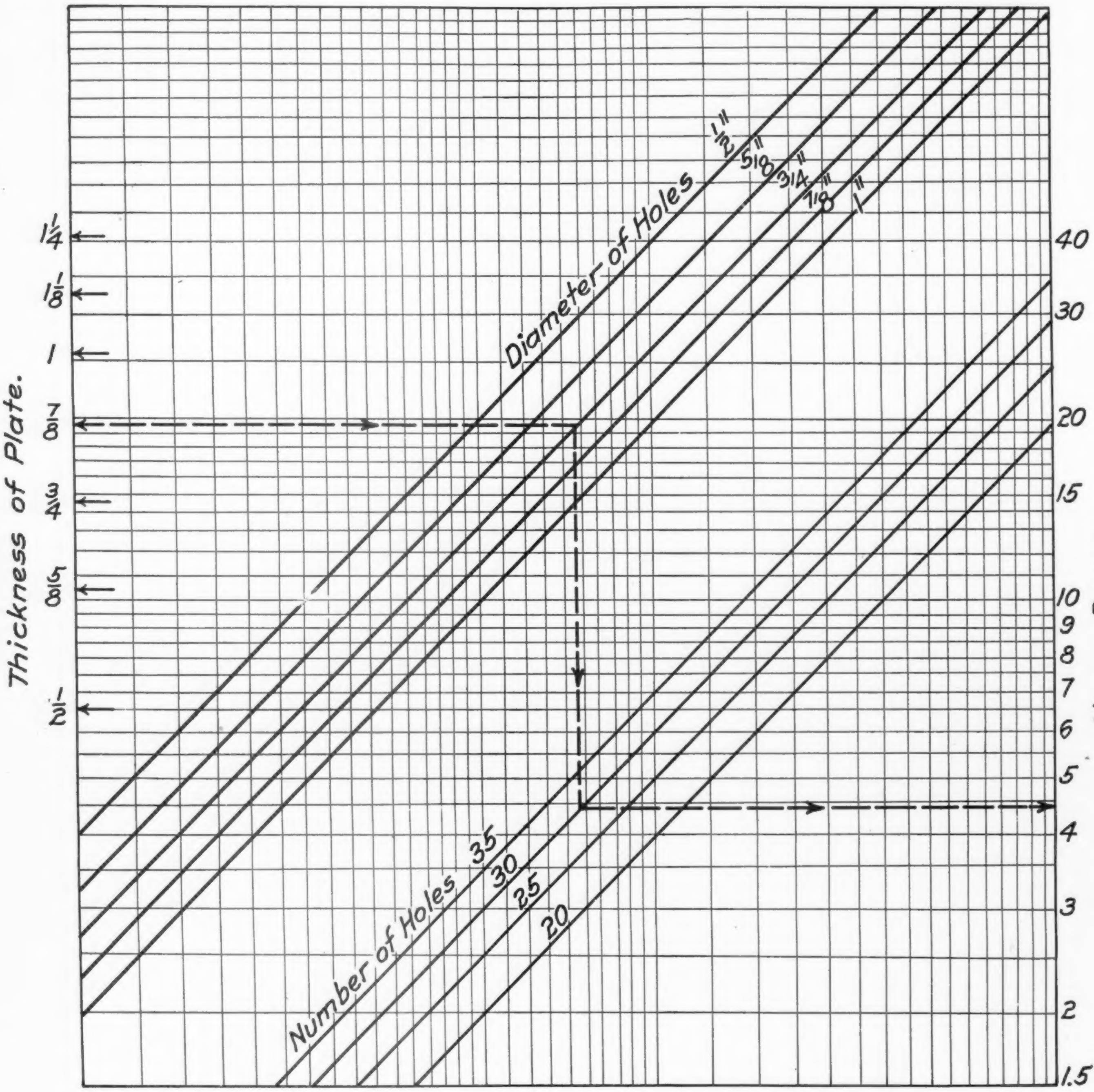
Combining (1) and (2) and allowing for the efficiency of the machine and driving mechanism we have

$$\frac{\pi \times t \times d \times 60{,}000 \times t \times N \times E}{33{,}000 \times 12 \times .75 \times 80}$$

Cancelling and reducing, we have

$$\frac{t^2 \times d \times N}{3.78} \quad \text{......... 3}$$

This formula is the basis on which the accompanying diagram is constructed.



Horse Power Required to Punch Holes in a Steel Plate of 60,000 Lbs. Tensile Strength.

When using the diagram the required thickness of the plate is taken on the scale at the left, and the line is followed horizontally to the right, to its intersection with the diagonal for diameter of hole; thence vertically downward to the diagonal for number of holes punched a minute, and then horizontally to the right where the required horsepower is found.

SHOP KINKS FROM THE FRISCO*

BY J. C. BREKENFELD,
Assistant Machine Shop Foreman, St. Louis & San Francisco, Springfield, Mo.

CLAMPS FOR HOLDING DRIVING BOXES.

The angle and T-shaped castings, shown in Figs. 1 and 2, are used for clamping driving boxes to the bed of the planer for machining the shoe and wedge faces. They are so arranged

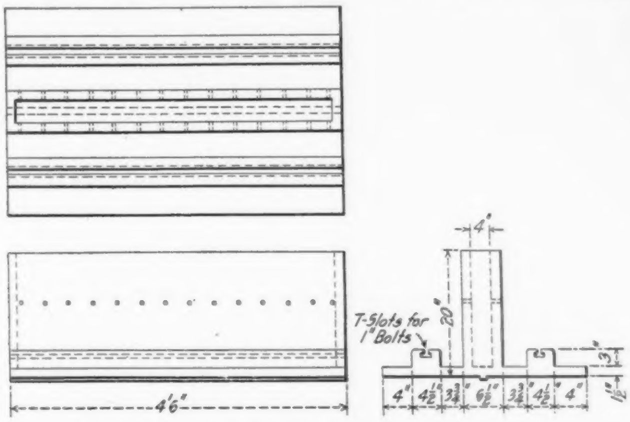


Fig. 1—Clamps Used for Planing Driving Boxes.

that the faces rest directly on the projection, which is 4½ in. wide. The T-slot extending through it is for clamping the box to the casting. This device insures the two faces being planed parallel. The lug on the bottom of the casting fits into the slot of the planer, and the casting is held in position by ordinary

Fig. 2—Angle Clamp for Planing Driving Boxes.

extension clamps. The T-shaped casting is used where the planer has two tool heads. Fig. 2 shows the application of the angle clamp, which is similar to the T-clamp, ribs being cast on the outside to give additional strength.

CLAMP FOR LIFTING TIRES.

A simple arrangement for lifting tires in and out of a boring mill is shown in Figs. 3 and 4. It holds the tire in a horizontal position, making it easy to handle and convenient to place on

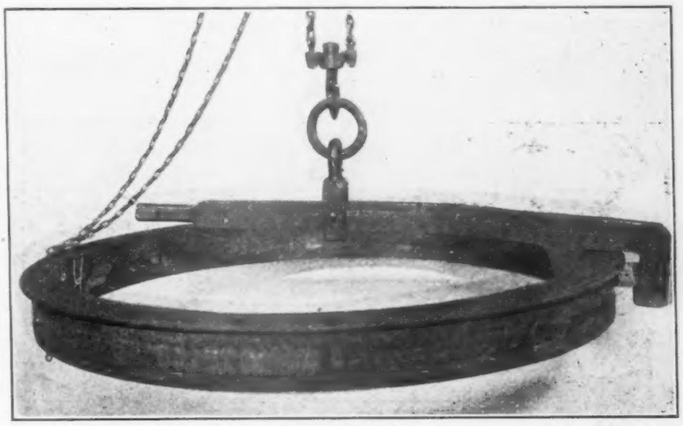


Fig. 3—Lifting Clamp for Tires.

the machine. By shifting the sliding block, which carries the hoisting ring, the different sizes of tires are balanced. This block is held in position by a set screw. The clamp is fastened

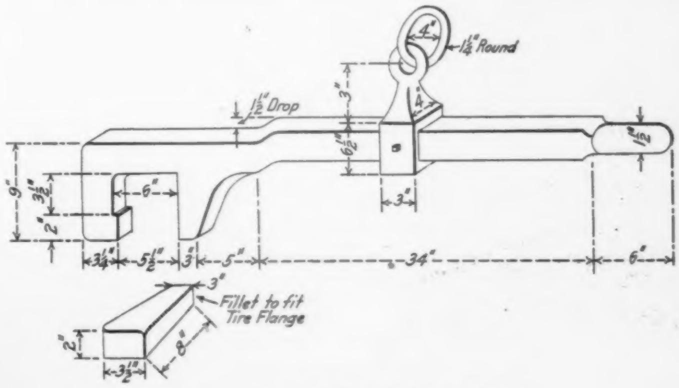


Fig. 4—Details of Tire Lifting Clamp.

to the tire by a wedge driven in between the jaw and the tire face just under the flange, making a secure fastening as well as a quick one.

RADIUS PLANER ATTACHMENT.

With the arrangement shown in Figs. 5 and 6, cylinder saddles may be planed in a much shorter time than it takes to

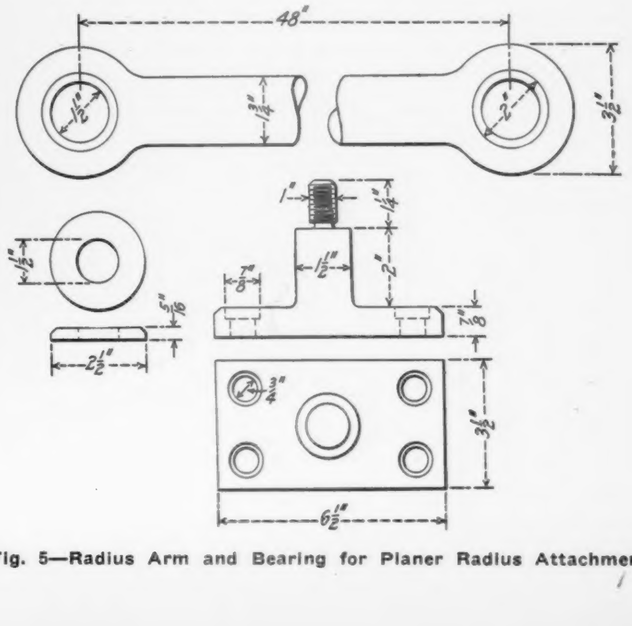


Fig. 5—Radius Arm and Bearing for Planer Radius Attachment.

*Awarded first prize in March 15, 1912, Shop Kink Competition.

chip them. In the case of a double head planer the arrangement is very simple. The left hand head, as shown in Fig. 6, is fixed at a point which is approximately the center of the arc to be planed on the cylinder saddle. The four bolts that control the swinging movement of the head are released and a 4-ft. rod extends, as shown, from the top of the tool slide to the top of the tool slide on the right hand head. As the right hand head is moved along the cross-bar, it will swing the other head

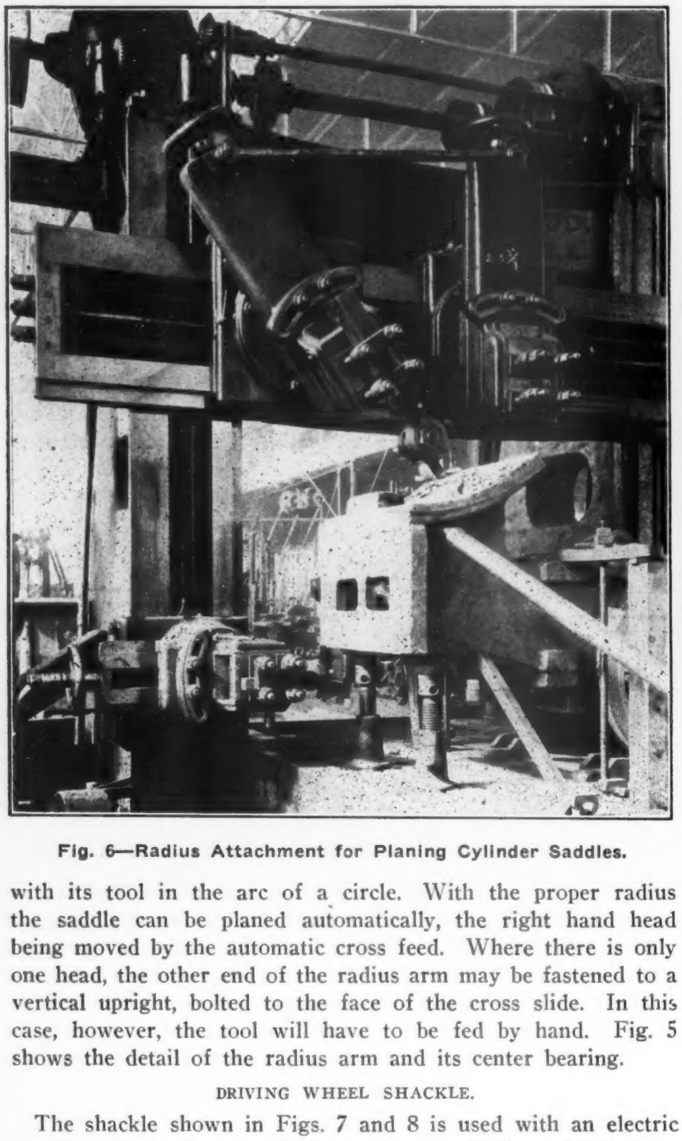


Fig. 6—Radius Attachment for Planing Cylinder Saddles.

with its tool in the arc of a circle. With the proper radius the saddle can be planed automatically, the right hand head being moved by the automatic cross feed. Where there is only one head, the other end of the radius arm may be fastened to a vertical upright, bolted to the face of the cross slide. In this case, however, the tool will have to be fed by hand. Fig. 5 shows the detail of the radius arm and its center bearing.

DRIVING WHEEL SHACKLE.

The shackle shown in Figs. 7 and 8 is used with an electric traveling crane for transferring mounted driving wheels from

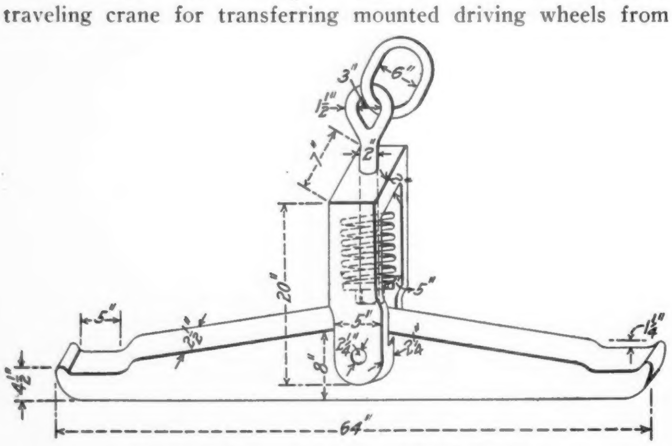


Fig. 7—Details of Driving Wheel Shackle.

one part of the shop to another, and for moving the wheels in and out of journal and tire turning lathes. The wheels always hang level and are easily placed on the centers of the machine. The large coil spring in the yoke of the shackle relieves the strain on the lathe centers, should the crane operator lift too heavily with the cables when taking the wheels out of the machine. This method of carrying wheels eliminates the danger

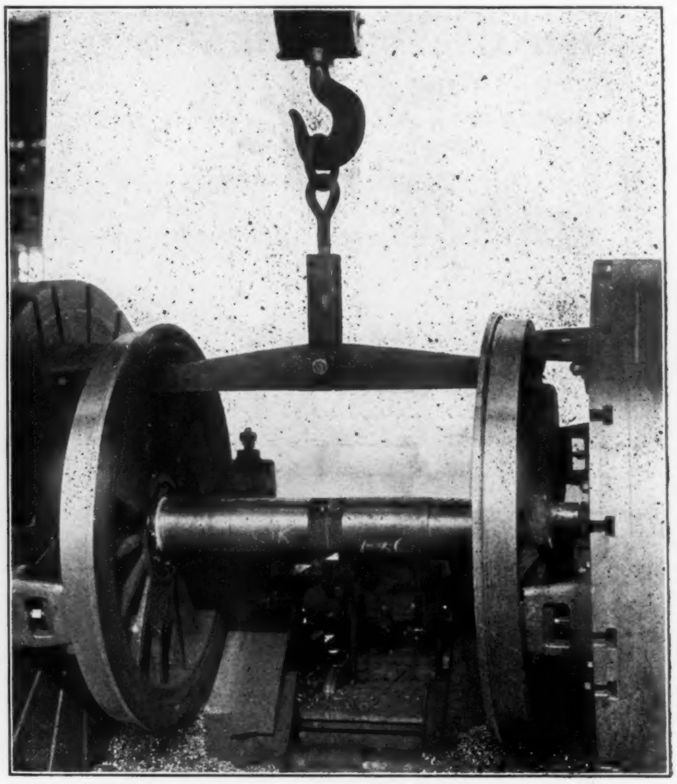


Fig. 8—Shackle for Lifting Driving Wheels.

of chains and hooks coming undone and breaking, which might injure the workmen.

HEAVY LATHE DOG.

The dog shown in Fig. 9 was made primarily for turning crank pins and driving axles. It grips the work at four points and has greater leverage for making this grip than the ordinary set screw dog. It consists of two angle plates, as shown,

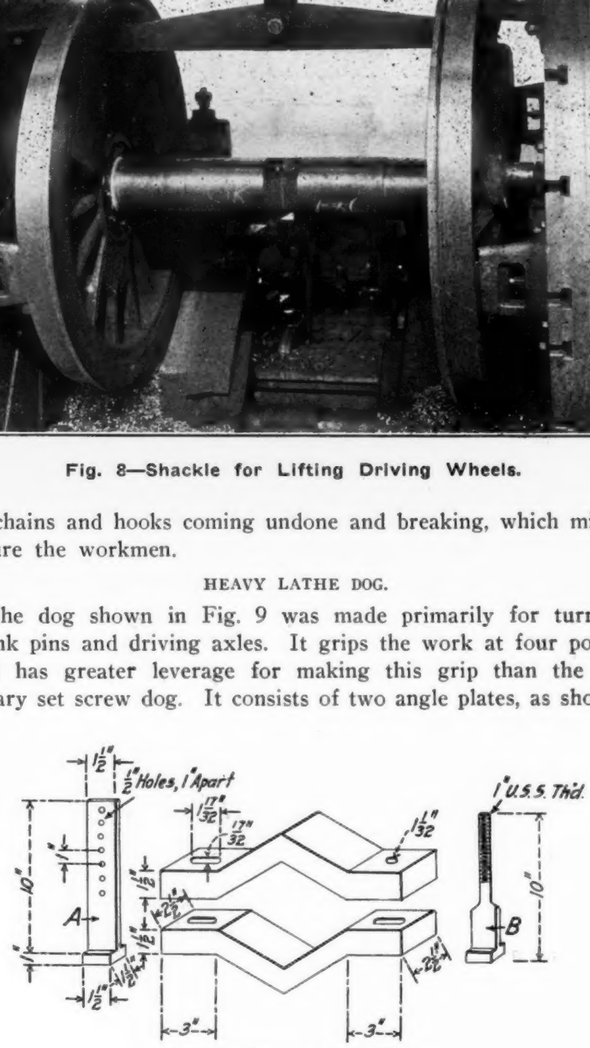


Fig. 9—Heavy Lathe Dog.

which are held on one side by the T-rod *A*, which has a series of ½-in. holes for a pin, to allow for adjustment. The other side is held by the T-bolt *B*, which is tightened by a 1-in. nut.

DRILL PRESS CHUCK.

A convenient chuck for a drill press, especially on locomotive work, is shown in Fig. 10. It consists of the base *A*, with a fixed jaw, and the sliding piece *B* with the movable jaw, which is operated by a lead screw. A drill press with one of these chucks will easily produce 50 per cent. more work than with the ordinary clamping methods, as no time is lost by the operator looking for bolts, clamps or blocks. There are very few

jobs within the capacity of the machine that cannot be handled in this chuck.

PNEUMATIC SHEARS AND CABINET FOR STUDS AND BOLTS.

A system used in making and storing studs and bolts is shown in Figs. 11 and 12. A pneumatic shear is used to cut off the studs and bolts which are chamfered in a drill press, threaded in an Acme double-head bolt cutter, and stored away in the cabinet shown in Fig. 12. The shears will cut material up to 1¼ in. in diameter. They are constructed as shown in Fig. 11.

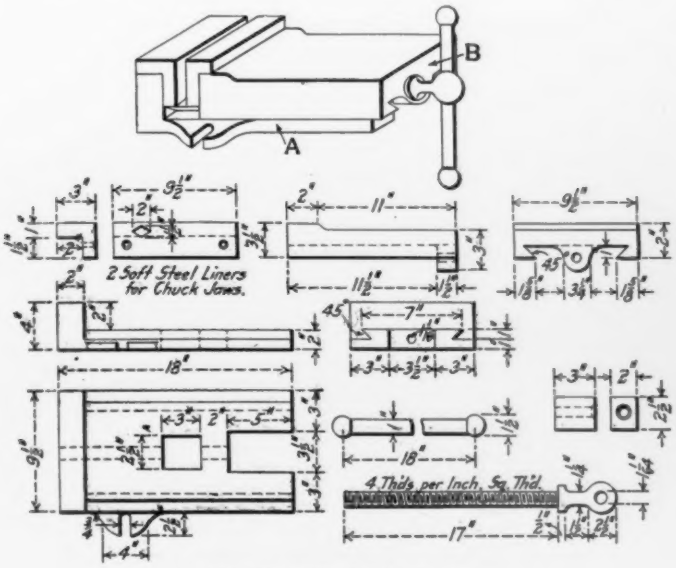


Fig. 10—Drill Press Chuck.

An old 14-in. x 12-in. air brake cylinder is used to operate the lever. The air is admitted by pressing down on the treadle in front of the machine and the shear is forced back to its normal position by the spring. With this system, studs up to and including 1 in. in diameter may be manufactured for a labor cost of ¼ of a cent each. The cabinets are made of heavy galvanized iron and are well braced. Each section will hold about 100 studs, which gives the cabinet a capacity of about 8,000 studs.

AIR PUMP TESTING STANDS.

The racks or stands shown in Fig. 13 are used for holding air pumps while they are being overhauled and tested. They are mounted on a concrete floor which is sloped so that the water leaking from the testing pipes may drain off to the sewer. The pumps are bolted directly to tables, which are pivoted on top of the stands in such a way that they may be swung to any angle and held by a clamp operating in a slotted arc. While on the stands, the pumps may be connected to the various steam, exhaust and air lines for testing. The discharge of the pump is connected directly to the shop line, so that the

Fig. 12—Shears and Cabinet for Studs and Bolts.

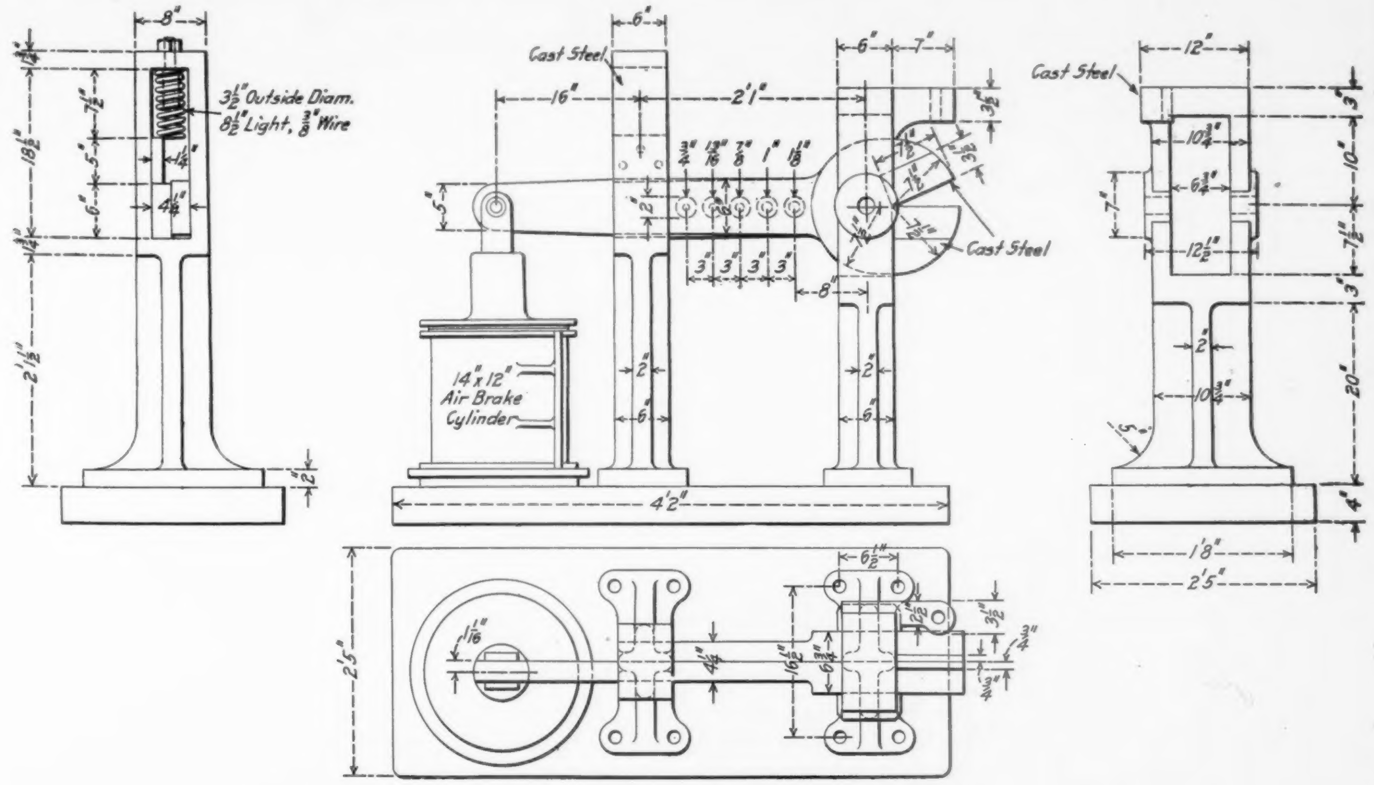


Fig. 11—Details of Pneumatic Shears for Cutting Studs and Bolts.

compressed air may be made use of throughout the shop. With these stands, considerable unnecessary handling of the pumps

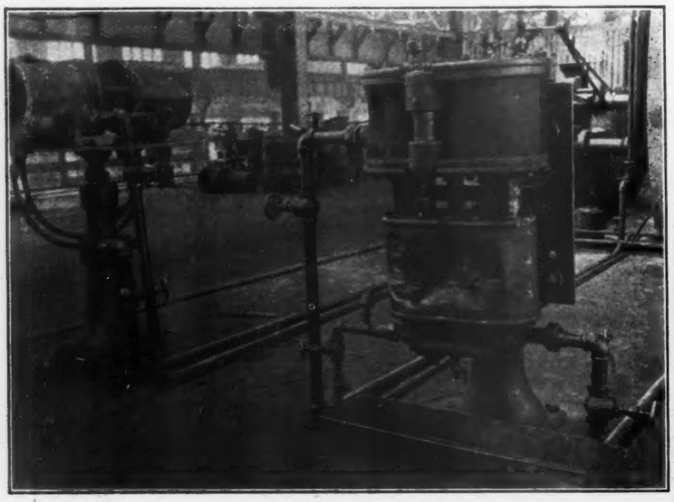


Fig. 13—Stands for Testing and Repairing Air Pumps.

is done away with, making the work of the repair man a great deal easier.

SMALL PNEUMATIC PRESS.

The small press shown in Fig. 14 was constructed for the purpose of pressing valve chamber bushings in air pump cylinder heads, thereby eliminating the loss of bushings due to break-

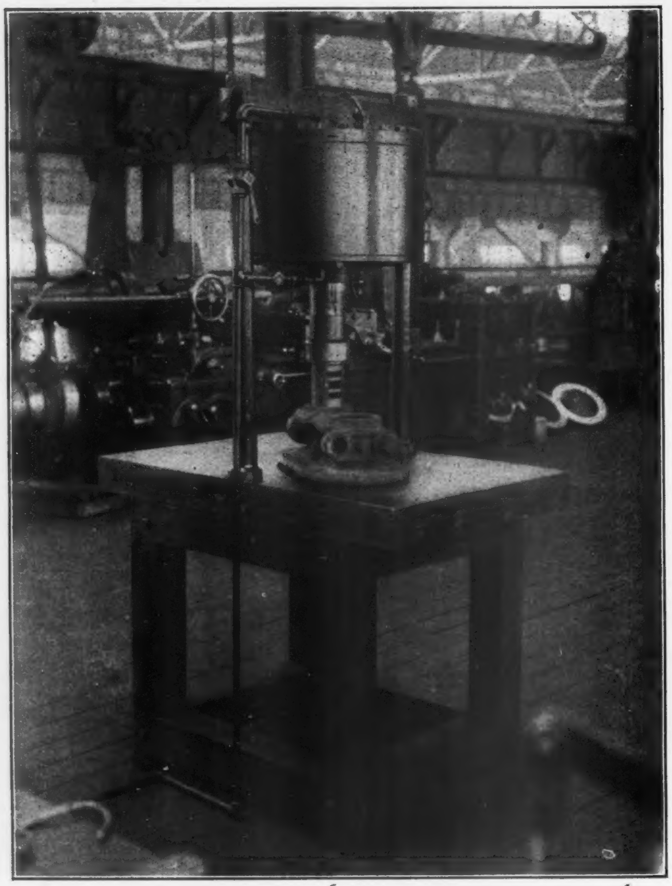


Fig. 14—Pneumatic Press for Bushing Work.

age caused by driving them in with a hammer. It is operated by two valves, one for the upper end of the cylinder and one for the lower end. When the upper one is open the pet cock on the under side should be open to allow for the exhaust of air from below the piston, and for the same reason the upper pet cock should be open when air is admitted on the under side of the piston. This press may also be used for pressing in bushings on motion work, etc.

ECCENTRIC DRILLING JIG.

The jig shown in Figs. 15 and 16 is used on a radial drill for drilling eccentrics and eccentric straps. It is composed of an angle casting which is bolted to the table of the machine. This casting in turn supports a smaller angle clamping plate

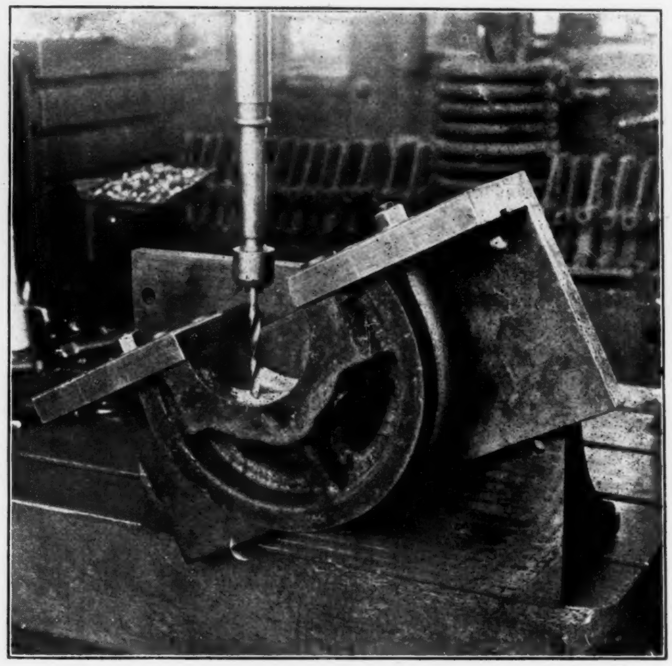


Fig. 15—Eccentric Drilling Jig.

by a pin, which allows the plate to be swung to any angle. The eccentric is fastened to the under side of the angle by a semi-circular yoke which is threaded on the ends and held

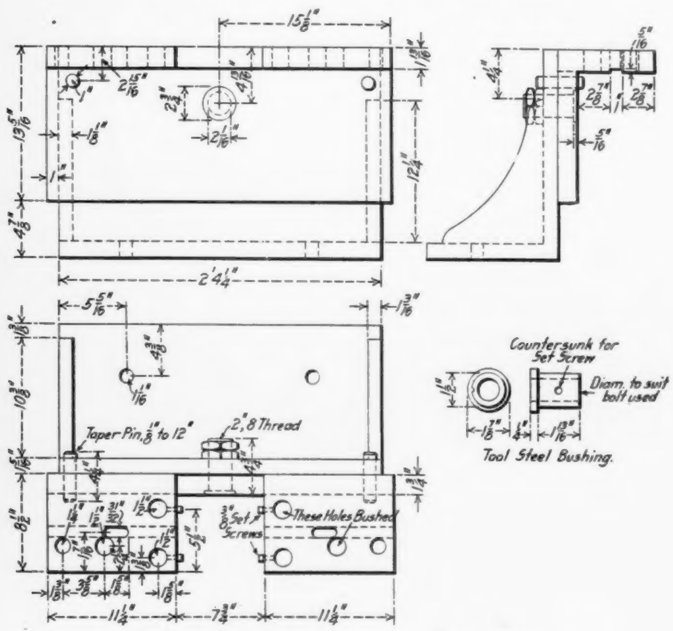


Fig. 16—Details of Eccentric Drilling Jig.

in the plate by two nuts. As will be seen in Fig. 16, the under side of the angle has a slot by which the eccentric may be centered. With this device the set screw holes may be drilled and tapped. When drilling for the stud bolt holes, the angle plate is swung around to a horizontal position and is held there

by two taper pins extending through the plate and the casting. Eccentric straps are drilled on the same jig in a similar manner.

LATHE CHUCK CRANE.

A small crane that may be attached to the back of an engine lathe bed convenient to the spindle is shown in Fig. 17.

Fig. 17—Crane for Removing Heavy Lathe Chucks.

It is used for taking off and putting on heavy chucks, making it possible for one man to handle the chuck easily. The crane post is 2½ in. in diameter and 6 ft. high, the lower end resting in a box imbedded in the concrete foundation of the machine. It is supported by a bearing which is fastened to the bed of the lathe by means of cap screws. The arm, or runway, is made of two pieces of 1½-in. x 2½-in. iron, bolted to the top of the post with sufficient space between them to allow for a four-wheel trolley. The carriage of this trolley contains a screw hoist on the end of which is a yoke to which the chucks are fastened. When the chuck is not in use on the lathe, it is held suspended out of the way of dirt and injury from passing trucks by this yoke.

CLAMPS FOR CROSSHEAD.

The device shown in Fig. 18 is used for clamping a crosshead to a planer while the guide faces are being planed; in this way the faces will be parallel to the piston rod. A series of mandrels having the various piston rod fits are kept in a metal rack so that it is unnecessary to have each crosshead fitted with its own piston rod for planing.

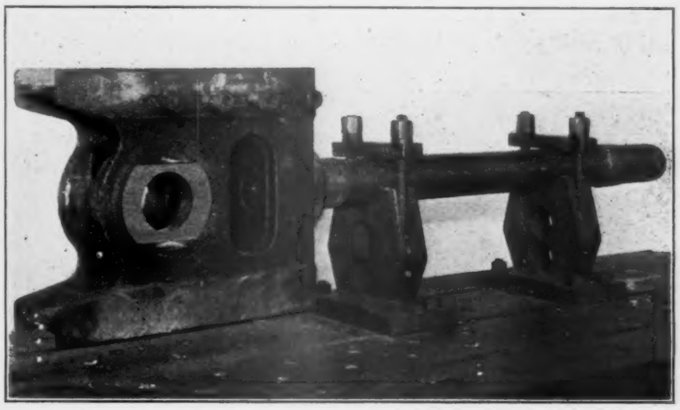


Fig. 18—Clamps Used for Planing Crossheads.

RADIUS ATTACHMENT FOR SLOTTING MACHINE.

The apparatus shown in Fig. 19 is used for slotting quadrants, links and other radius work. It consists of an arm which is rigidly fastened to the bed of the slotter. The sliding

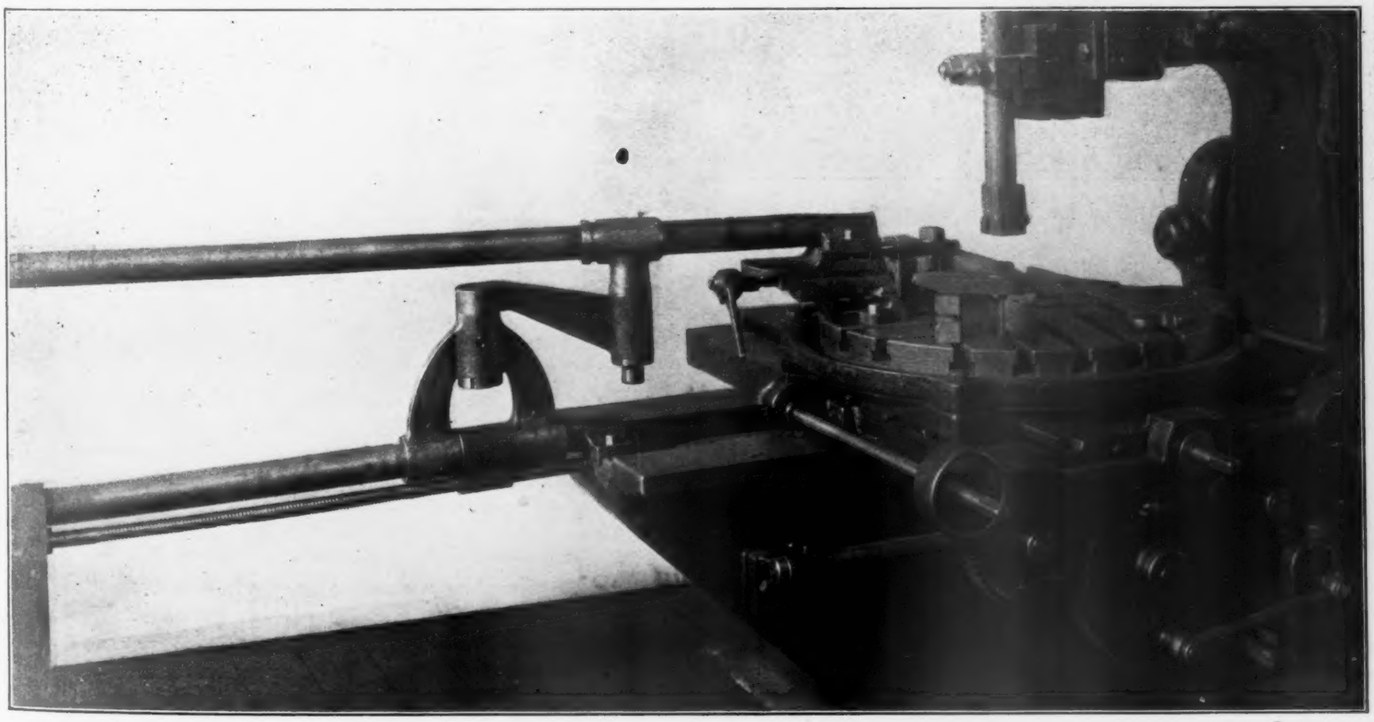


Fig. 19—Radius Attachment for Slotting Quadrants, Links, etc.

head, or support for the radius arm, is moved by an adjusting screw underneath the bar which is held at the front of the slotter bed. The bar is graduated in half inches, and when being set to any required radius, the sliding head is moved back to the nearest graduation to give the required radius. The exact radius is then found by means of a tram, one point of which is placed in the center of the sliding head and the other at the work. The exact distance and adjustments are made by a smaller adjustment screw at the end of the radius bar. When using this attachment, the screw to the lower table of the machine is disconnected, allowing the table to be guided by the radius arm.

SAFETY VALVE TESTER.

The arrangement shown in Fig. 20 was devised to quickly test safety valves and thus save time over the old method of waiting until the boiler had developed sufficient pressure to do the work. The reservoir on the right is connected to the shop air line and is always charged to a pressure of about 90 lbs. The left-hand reservoir is also connected to the shop line and after being charged the connection is closed and a connection is opened to the air pump which raises the pressure to that desired for testing. The safety valve is connected to this reservoir through the gate valve that is directly in front of it. The connection is made by nipples so that various sizes of safety valves may be tested. The safety valves are set from 3 to 5 lbs. higher than the required engine rating, according to the size of the value and to whether it is set at a high or low pressure.

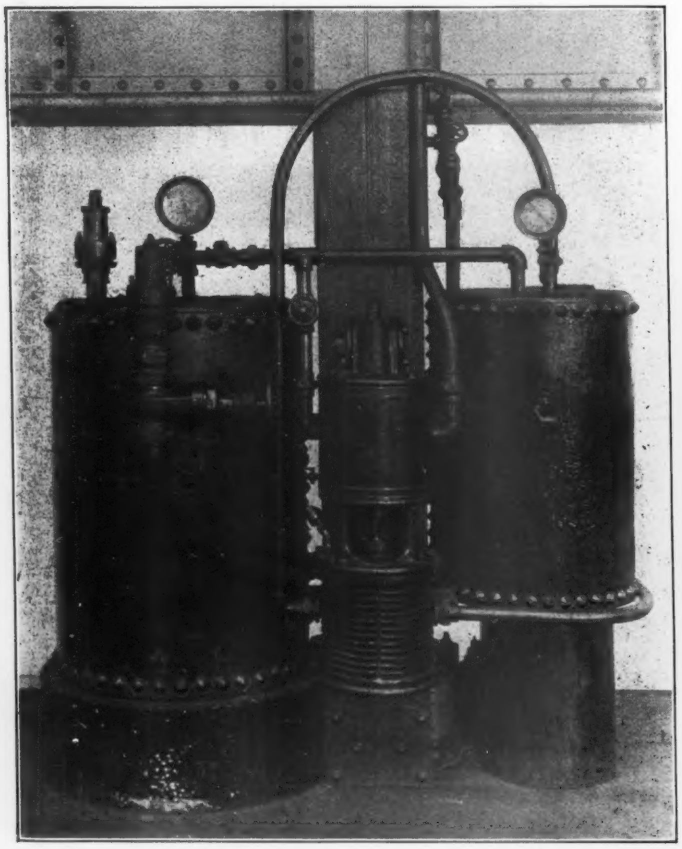


Fig. 20—Air Tanks for Testing Safety Valves.

TIRE GAGE.

A convenient and light weight tire thickness gage is shown in Fig. 21. It is made of 1/16-in. sheet steel and has a scale marked on it which is divided into sixteenths of an inch. Being light and small, it is easily carried around in a pocket, where one will always have it handy. The illustration shows the method in which the gage is used.

METAL TOOL CABINETS.

A tool cabinet that is made of cast iron angles and sheet iron is shown in Fig. 22. The supports are 2 in. x 2 in. x 12 in., and are made hollow to reduce the weight, having recesses cast in one end for receiving the bolt head and bottom supports.

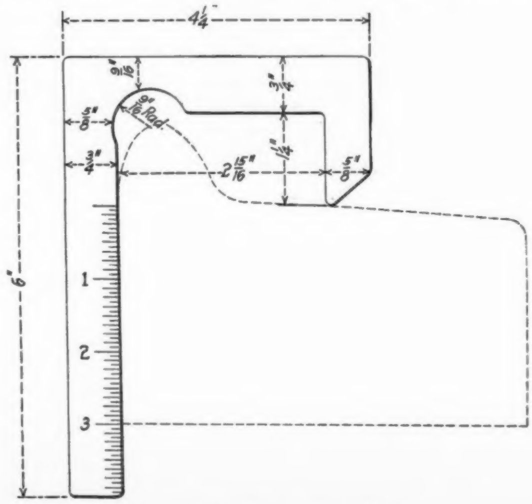


Fig. 21—Tire Thickness Gage.

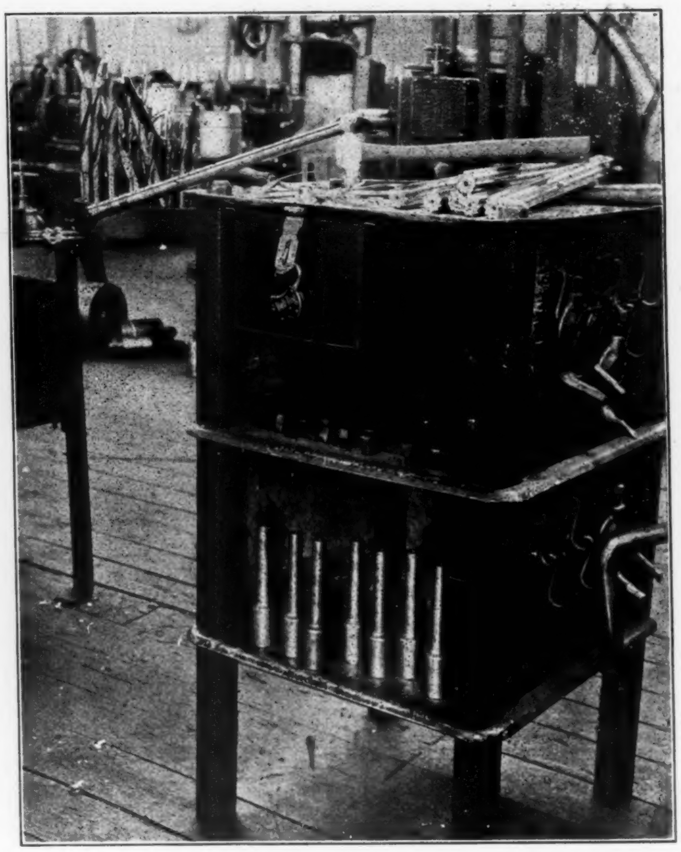


Fig. 22—Metal Tool Cabinet.

ZINC PRODUCTION.—The production of zinc in Europe during 1912 was 650,670 tons, which is 27,750 tons more than the production of 1911.

RAPID TRAVELING.—From New York to Burlington, Vt., a distance of about 300 miles, which thirty years since was a ten days' journey, may now be performed with great ease (if the steamboat were to leave Whitehall at 5 p. m.) in thirty hours.—From the *American Railroad Journal*, October 6, 1832.

Car Department

MAKING STOCK CARS FROM SCRAPPED BOX CARS

BY WM. QUEENAN,
Assistant Shop Superintendent, Chicago, Burlington & Quincy, Aurora, Ill.

Some years ago the Burlington appointed a committee to inspect and report on the general condition of a lot of old low capacity freight cars. The committee made a careful inspection of a great many of the different classes of these cars and recommended that a maximum limit of expenditure be placed on them, the age and class of car to determine the amount of money to be spent. The recommendation was approved and affected cars of from 18 to 23 years of age. When one of these cars comes on the repair tracks, it is carefully checked over, and if it is found that it will cost more money to put it in condition to give service for at least three years, barring accident, than the limit allows, the car is stenciled "condemned." A blank form is then filled out, showing in detail all the repairs necessary to put it in good condition and the estimated cost. This form is sent to the general officers. If the recommendation is approved the car is destroyed.

The practice of destroying cars is very interesting. If carefully followed up, an immense amount of good, usable material can be recovered and used on other cars of a like capacity. After we had been destroying cars in this manner for some time we accumulated a very large amount of good material that we had no use for—we were getting more than we needed to make repairs to the same class of equipment. A large number of the cars destroyed in the last two years were of 60,000 lbs. capacity, and they had very good trucks of the arch bar type, and metal bolsters. With this and other material it was found that we could build a stock car of 60,000 lbs. capacity and use up this material, which would be putting it to much better use than selling it for scrap.

The stock car decided upon is of the following dimensions:

Length over end sills	36 ft. 11 in.
Width over side sills	8 ft. 9⅝ in.
Width over end sills	9 ft. 8 in.
Width over roof	9 ft. 9¼ in.
Height from top of rail to top of running board	12 ft. 5 11/16 in.
Height from top of rail to top of brake shaft	13 ft. 8¼ in.
Length inside	36 ft. 1⅝ in.
Width inside	8 ft. 6⅞ in.
Height inside	7 ft. 4⅝ in.

The framing of the car is what is known as outside framing, the post pockets being bolted into the side sills in the same way as on a coal car, but having a flange resting on top of the side sill. The side sills and the intermediate sills are 5-in. x 9-in. fir. The center sills consist of two 9-in. 25-lb. channels. The draft arms are flanged plates 5/16 in. in thickness. The cars are fitted with metal brake beams, tandem spring draft gear, and what are known as 13-B trucks. The total weight of the car is 30,500 lbs. The wooden sills and the flooring are treated with creosote.

From such material we have built 1,275 new stock cars. The first 250 were double deck sheep cars; the balance were single deck 60,000-lb. capacity cars, with steel center sills. We are now working on an order on which we have 175 more cars to build. We have another order, on which we have not commenced work, for 100 double deck sheep cars. These cars are equal to any low capacity stock car being built, either at railroad shops or at contract shops, notwithstanding the fact that a large portion of the material that goes into their construction was released from destroyed cars and recovered from the scrap yard. The average cost for labor on all the above-mentioned cars is 14 per cent. of the total value, making the material value 86 per cent. of the total. Forty-six per cent. of the material was recovered from destroyed cars and the scrap yard.

The following is a list of the principal material that was released from destroyed cars and used on these cars. All material used we considered equally as good as new:

Top and bottom arch bars and tie straps.
Metal truck bolsters.
Metal spring planks.
Springs, nested.
Column guides.
Journal boxes.
Journal box wedges.
Axles, with journals 4¼ in. x 8 in.
Air brake equipment complete.
MCB couplers, including the yokes, followers, springs, and follower guide straps.
Draft castings suitable for tandem spring.
End door staples, brackets and back stops.
Side door Climax hangers, and Z-bar door tracks.
Brake shaft roof brackets.
Truss rod washers.
Door handles.
Needle beam truss rod struts.
Truss rod turnbuckles.
Body bolster truss rod struts.
Body bolsters.
Truss rods.

The wheels and the journal brasses were bought new, as we do not get any surplus of wheels that we cannot use in repairs.

The journal box bolts and column bolts are made of old bolts pieced out by welding to the required length. The box bolts are 1⅛ in. in diameter, the column bolts 1¼ in. The bolt to be welded is first cut a suitable length, one piece having a head and the other being a straight piece of iron. The ends to be welded are then upset on a forging machine, the upset being ⅜ in. larger than the original diameter of the bolt. They are then moved to a Bradley hammer and welded. We have made several laboratory tests of the strength, which proved very satisfactory. A large number of the bolts have been in service for over two years and we have had no complaints. We are welding bolts from ⅞ in. to 1⅝ in. diameter and are saving at least 35 per cent. by doing so.

The body bolster top member is ¾-in. x 8-in. iron, and the bottom member 1-in. x 8-in. iron. By working over old body bolsters the cost is only about one-half of what it would be if made of new iron, and the old bolsters are as good and answer the purpose. The same is true of the truss rods. The truss rods from old cars are too short, as they were originally used on 34-ft. cars. We cut up the old rods to suitable lengths and piece them out by welding. The truss rods made of old rods cost about 30 per cent. of what they would of new iron. The cars are equipped with four truss rods, 1⅜ in. in diameter, with the ends upset to 1¾ in. All the forgings, including the brake rods and brake levers, used on the new stock cars are recovered from destroyed cars. All the vertical tie rods used in the construction of the new stock cars are of new iron. We also recover about $25 worth of good, usable lumber from the old box cars, and while none of this lumber goes into the construction of the stock cars, we are making good use of it on other cars. One item is parts of good 5-in. x 9-in. car sills, which are long enough to make sill splices. Parts of this lumber that are not defective are well seasoned and are just as good as new. Last year we recovered over 2,300 pieces of timber about 12 ft. in length for making sill splices.

DEVELOPING EFFICIENT CAR INSPECTORS*

BY C. J. WYMER,
General Car Foreman, Chicago & Western Indiana.

Car inspectors may be classified as terminal and interchange inspectors. Their duties in many respects are the same, and in others so different that an inspector thoroughly capable on terminal work might prove very incapable on interchange work. The most important duty of a terminal inspector is to discover defects in equipment and be qualified to pass judgment as to whether the defects are of such a nature as to make the movement of the equipment hazardous to life and property. Ideal interchange inspectors must possess all the qualifications of a terminal inspector, as well as additional qualifications, and are the most difficult to obtain.

An inspector must be a careful workman and should possess a practical knowledge of car construction. He must interchange cars and place responsibility according to M. C. B. rules and other regulations. He must have definite knowledge of both state and federal safety appliance laws and their regulations relative to handling explosives and inflammable material. He must determine if the lading is properly loaded and protected, and in some instances record seal records. He must avoid excessive delays to traffic due to inspection or be a subject to criticism. Accuracy and activity meet this requirement. He must perform long hours of toil, endure the inclemencies of weather and be regular in service. To do this, he must be of good physique and of exemplary habits. He must record and transmit intelligently to his superiors his various performance of duties. This requires a good average education. He must be of strong moral character. Thousands of lives and millions of dollars in property are daily entrusted to his judgment and he must not meet such responsibilities with a clouded brain through dissipation and irregular habits.

The ideal car inspector must, therefore, be a mechanic, a student, a scholar and a gentleman. After having reached this conclusion, our minds are instinctively turned to our shops from which source our supply should naturally come; they are rapidly filling up with employees who can neither speak nor write English. However, we do not regard the process of development so difficult; the real problem is the acquiring of suitable material to develop.

In indicating that our shops are filling up with a class of labor which cannot be developed into successful car inspectors, we do not mean to convey the impression that they make incompetent car men, for in fact many of them become very proficient in their work, but the fact remains that comparatively few can be developed into efficient car inspectors and, therefore, the effect is harmful so far as it affects the subject under discussion.

What cause has produced this effect and how can it be replaced with one producing the desired effect? The progress of the country has been so rapid during the past few years, that many positions have been created free from physical exertion and endurance which seem to have proved more attractive to a large percentage of young men than the shop. They have chosen to accept these even at a financial sacrifice on account of the future opportunities offered, or a desire to be free from physical exertion.

The other class who look upon toil as honorable and constructive to both body and brain have opportunities offering them greater financial returns and frequently with less responsibility and they naturally accept them. What the car department most needs is to secure the recognition it deserves among other branches of railroad service. It needs to be understood that just anything is not good enough for the car department, but that it is an important department and its efficiency very largely affects the earning capacity of the railroad. When this is understood and the car department has been given a setting in the railroad organization equal to its share of responsibility, there will be no scarcity of suitable material to develop.

There is a decided waste of talent and labor due to rules and regulations which require duplication of work without any corresponding return. Car inspectors were originally created to inspect cars for safety of life and property, but their work has so degenerated into a system of bookkeeping, that it actually causes neglect of their real duty. We mean the system of one inspector after another recording the same defects and taking copies of the same defect cards until the operation has been repeated many times without repairs being made, while as a matter of fact more important defects are neglected. If the practice of carding cars were abolished in its entirety, there would be a decided reduction of car inspectors required, a great conservation of labor and better inspection would be insured for really dangerous defects. It would seem that no thoughtful person can fail to see this waste and should be ready to co-operate in arranging regulations, having equable results without carrying with it what may be termed a willful waste.

A good car inspector should have a practical knowledge of car construction so as to reinforce his judgment as to the need of repairs to certain defects. This knowledge can best be obtained in actual shop experience, yet we have known of very capable car inspectors being developed through yard work, such as light repairman, oiler or inspector's helper.

Interested yard men when associated with inspectors possessing a definite knowledge of their work, develop into efficient car inspectors quite rapidly, but unless so associated their progress is much slower and their success less certain.

He must be a student, for there are many regulations to master and these are undergoing constant change and he must keep himself fully informed as to changes. He must be kept supplied with current literature affecting his work and must be encouraged in its study. He must interpret rules, regulations and laws which are capable of various interpretations by men of high education, and he must be proficient in making records and handling correspondence.

SUMMARY.

Do what you can to get the car department on an equal footing with other departments of no greater importance. When this can be accomplished as a general proposition, there will be plenty of available material.

Be careful in the selection of men and select only such men as are capable of developing the qualifications we have suggested.

Provide your inspector, and those you seek to develop, with all current literature affecting their work.

Arrange occasional meetings for the exchange of opinions and the imparting of instructions, and do your part in educating your men to be honest, industrious and of good habits. Show them that you can appreciate honest effort as much as you can censure neglect of duty.

*Abstract of a paper presented before the Car Foremen's Association of Chicago at the May meeting.

Traffic Through Canadian Canals.—The traffic passing through the canals of the Dominion of Canada in the year 1912 was 47,587,245 tons, an increase of 9,556,892 tons over 1911.

Ship Building in Scotland.—The total output of the Scotch ship yards for the month of May, last, was 62,006 tons, of which 56,836 tons, comprising 37 vessels, was produced on the Clyde.

The Highest Smoke Stack.—The smoke stack at the smelter of the Boston & Montana Consolidated Copper & Silver Mining Company, Great Falls, Mont., which is 506 ft. high, is said to be the tallest in the world.

One Hundredth Anniversary of the Locomotive.—In June, 1813, 100 years ago, the first practical locomotive propelled by steam power was produced by William Hedley and Timothy Hackworth. This locomotive, which was for use on a colliery railroad, was named the "Puffing Billy," and is still to be seen in the South Kensington Museum.

METHOD OF DESIGNING A STEEL GONDOLA CAR

Awarded the Second Prize in the Car Department Competition Which Closed February 15.

BY L. W. WALLACE,
Assistant Professor Car and Locomotive Design, Purdue University.

The purpose of this article is to show the method of designing those parts of a steel gondola freight car that are usually given theoretical consideration. These will include the axle, the truck bolster, the truck side frame and the steel underframe consisting of the body bolster, the center sills and the side sills.

Before beginning the design, it is necessary to make certain assumptions as to the capacity and weight of the car, and also as to its general dimensions. We shall assume the capacity to be 100,000 lbs.; light weight, 40,000 lbs.; general dimensions, inside length, 42 ft.; inside width, 9 ft. 6 in.; distance between truck centers, 32 ft.

AXLE DESIGN.

The axle will be designed by the graphical method authorized by the M. C. B. Association and published in the proceedings for 1896. The loading on each axle embraces the loads on the two journals, and is determined as follows:

Weight of car body and trucks	40,000 lbs.
Capacity of car plus 10 per cent. overload	110,000 lbs.
Total	150,000 lbs.
Add 20 per cent. for oscillation	30,000 lbs.
Total	180,000 lbs.
Deduct weight of wheels and axles	9,000 lbs.
Weight on all axles	171,000 lbs.
Weight on each axle	42,750 lbs.
Weight on each journal	21,375 lbs. / 21,400 lbs. used

In designing the journal of the axle, the load may be assumed to be at the center of the journal, but in designing the remainder of the axle allowance is made for the wear of the parts, which permits the brass to move towards the end of the journal, applying the load beyond the center. The amount of this movement is estimated as follows:

Wear on bearing	¾ in.
Wear on flange of axle	½ in.
Play between brass and bearing	⅛ in.
Total	1⅜ in.

Taking this outward movement into account, the distance between the two forces P_1 and P_2 for the 100,000 lb. car would be 6 ft. 5 in. + (2 × 1⅜ in.) = 6 ft. 7¾ in. as shown on Fig. 1. The track gage and center of the axle were located according to standard dimensions as shown.

The center of gravity of the car was then assumed to be 72 in above the rails. This, of course, is not presumed to be the center of gravity of all cars, but it is thought to be the maximum height attainable for any car with any class of loading. With the relative location of the rails, center of axle and center of gravity of the car established, the graphical determination of the stresses in the axle becomes the next step. Accordingly there was laid off to a scale of 20,000 lbs. to the inch, the weight W of 42,750 lbs., which is the load on each axle. The horizontal component due to curves, wind, etc., was laid off as H, which is usually considered as $.4W$. Complete the parallelogram with the center of gravity as one corner and the two forces, H and W forming two sides. The resultant R is drawn, letting it strike the rail where it will, cutting the axle AB at Q. With a load line *1—2* equal to W, divide the former so that *1—3* : *3—2* :: AQ : QB, which in this particular case is *1—3* : *3—2* :: *16.87* in. : *61.87* in., making *1—3* equal to *2.12* in. Take the pole distance, h, out from *3* any convenient distance, as 1½ in., and complete the triangle *102*.

Having established the figure *102* the moment diagram *ado* below the axle was constructed by drawing *a—d* parallel to *o—2* and *d—o* parallel to *o—1*. The moment diagram now being completed the moment at any point in the axle may be obtained by multiplying the ordinate at the corresponding point in the moment diagram by the pole distance h, each being taken at its proper scale. The ordinate *cd* scales 380,000 lbs., which multiplied by 1½ in., the pole distance h, gives a moment of 570,000 inch pounds. In like manner the moments at *ef* and *gh* were found to be 483,750 and 386,250 inch pounds, respectively. To find the required diameter, use the formula M = fZ, in which

M = the bending moment in inch pounds.
f = the allowable fibre stress, which is generally taken as 22,000 lbs. for all of the axle, except the journals which are figured for 10,000 lbs.

$$Z = \text{section modulus} = \frac{\pi d^3}{32}, \text{ for a round section.}$$

$$\text{Therefore } M = \frac{f \pi d^3}{32} = \frac{22{,}000 \times \pi d^3}{32} = 2{,}160.4\, d^3$$

By substituting in the above formula the bending moment of 570,000 in. lbs. which occurs at *CD*, and solving

$d^3 = 264$, or $d = 6.41$ in., 6½ in. was used.

In like manner the diameter at *EF* and *GH* was found.

The axle back of the wheel fit was accordingly drawn to conform to the diameters obtained by the graphical method just

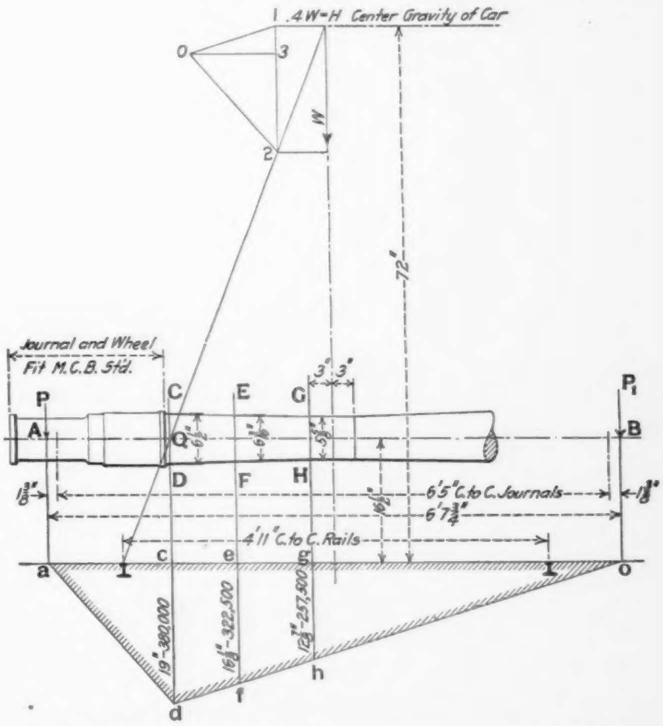


Fig. 1—Graphical Method of Designing an Axle for a 50-Ton Gondola Car.

described. The drawing shows the moment diagram for only one journal, but since the loading is symmetrical, both ends of the axle from the center out would be the same, hence it is not necessary to show the diagram for the right journal. The axle drawing was completed by making the wheel fit and journal conform to M. C. B. standard dimensions.

TRUCK BOLSTER.

The weight carried by each bolster was obtained in the fol-

lowing manner: The total weight of the car, loading and overload was found to be 180,000 lbs.; from this deduct 10,800 lbs., the estimated weight of the wheels, axles and side frames, which leaves 169,200 lbs., the load to be carried by the two bolsters. Therefore the load on each bolster is 84,600 lbs., or approximately 85,000 lbs.

In designing a truck bolster, two different loadings must be considered. One is the direct vertical load just found, and the other a transverse load received when the car is stopped by brakes, or otherwise. The amount of this transverse load is variously estimated. It is thought that the maximum amount will be equivalent to the force required to slip the wheels of the truck with the brakes applied, which amount will be the weight on the wheels multiplied by .22, the coefficient of friction between wheels and rails. For the car under consideration, this gives 85,000 × .22, or approximately 19,000 lbs.

The vertical loading may be applied in two ways. First, all of it may be at the center of the bolster, which of course would be the normal condition when the car is on a level track. Second, one-half of the load may be assumed to be at the center, and the other half on one side bearing, which occurs when the car is rounding curves or on an uneven track. The bolster should, therefore, be designed to take care of both of these conditions

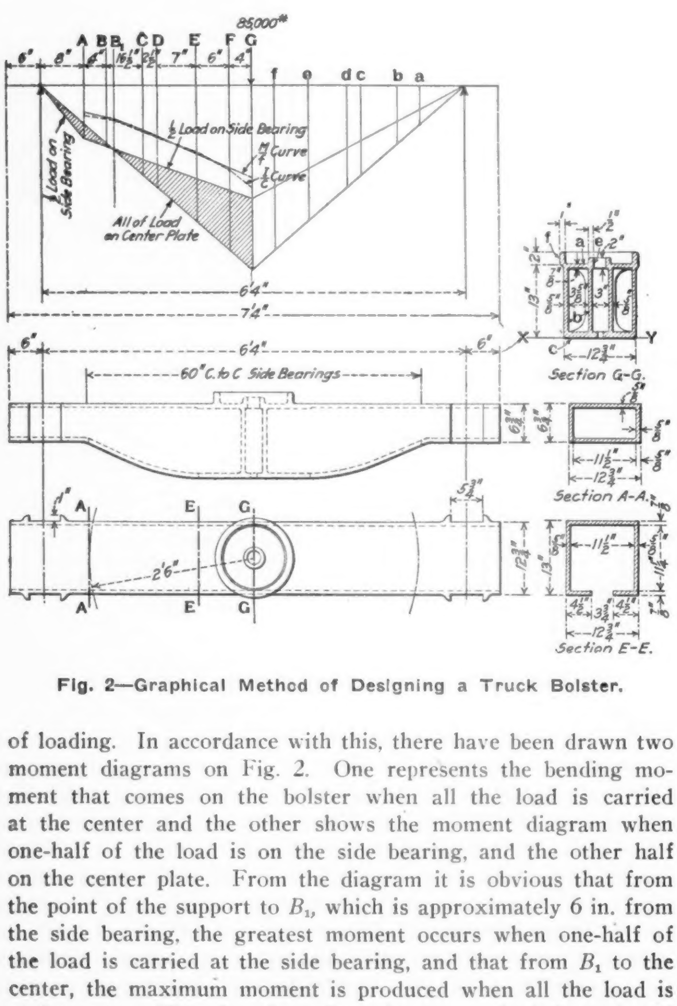


Fig. 2—Graphical Method of Designing a Truck Bolster.

of loading. In accordance with this, there have been drawn two moment diagrams on Fig. 2. One represents the bending moment that comes on the bolster when all the load is carried at the center and the other shows the moment diagram when one-half of the load is on the side bearing, and the other half on the center plate. From the diagram it is obvious that from the point of the support to B_1, which is approximately 6 in. from the side bearing, the greatest moment occurs when one-half of the load is carried at the side bearing, and that from B_1 to the center, the maximum moment is produced when all the load is at the center. Therefore from B_1 to the center, the bolster should be designed for the latter loading and from B_1 out to the end of the bolster, the moment due to the loading at the side bearing should be considered.

The moment diagrams were constructed by finding the value of the moments at the several points indicated. The bolster is considered as a simple beam supported at each end and having, first a concentrated load at the center, and second one concentrated load at the center and one at the side bearing. The maximum moment obtained at each point and for which the section was designed was as follows:

At side bearing (Sec. A—A)	474,200 in. lbs.
At B_1	541,300 in. lbs.
At C	786,200 in. lbs.
At D	892,500 in. lbs.
At E	1,190,000 in. lbs.
At F	1,445,000 in. lbs.
At G	1,615,000 in. lbs.

Using the common formula $M = fZ$, in which

M = bending moment,

f = safe fibre stress, which is 10,000 lbs. for cast steel, of which the bolster is to be made,

Z = section modulus.

From the above $Z = M/f$. Therefore the required section modulus at any point, as A, may be found by substituting the proper values, as follows: $ZA = 474,000 \div 10,000 = 47.4$. In which manner the other required Z's were found to be

ZA = 47.4	ZD = 89.2	
ZB = 54.1	ZE = 119.0	ZG = 161.5
ZC = 78.6	ZF = 144.0	

These values were plotted as shown in Fig. 2, and the resulting curve marked M/f curve.

Having found the required section modulus for each section, as above outlined, the next step is to design a section to satisfy the required section modulus or Z at each point. As an illustration of how this is done two sections as *G—G*, and *A—A* will be worked out. The required section modulus Z at the center, and which is for section *G—G*, may be expressed by the following formula

$$Z_{gg} = \frac{M}{f} = \frac{1,615,000}{10,000} = 161.5.$$

Assume a section as shown at the lower part of Fig. 2. This is composed of rectangles; therefore, the section modulus of the entire section may be easily obtained. An inspection of one-half of this section about the vertical axis shows that it is composed of seven small rectangles, designated as a, b, c, etc. In order to find the section modulus Z of the entire section, it becomes necessary to find the center of gravity of the section. This may be expressed by the following formula:

$$C. G. = \frac{a_1 x_1 + a_2 x_2 + a_3 x_3}{A}$$

in which a_1, a_2, etc., is the area of each separate divisional unit and x_1, x_2, etc., is the distance from the center of gravity of each divisional unit to some arbitrary reference line taken as *X—Y*. A = the sum of all the small areas, or the total area of that portion of the section considered. Substituting the values,

$$C. G. = \frac{(4.26 \times 12.12) + (14.06 \times 6\tfrac{1}{4}), \text{ etc.}}{26.45} = 6.89 \text{ in.}$$

That is, the center of gravity of the section is 6.89 in. above the reference line *X—Y*.

The moment of inertia for the entire section may be expressed as

$$I = (I_a + A_1 R_1^2) + (I_b + A_b R_b^2), \text{ etc.}$$

In which I_a, I_b, etc., equal the moments of inertia of each small section about its own gravity axis and for a rectangular section is equal to $\frac{bh^3}{12}$. In which b is the thickness in inches and h the height in inches. a_1, a_2, etc., equals the area of each unit, R_1, R_2, etc., the distance from the center of gravity of each divisional unit to the center of gravity of the entire section. Since the value of $\frac{bh^3}{12}$ for each of the divisional units is very small, it will be dropped for all of the subdivisions except b, wherein it has material value, but in this subdivision the AR^2 becomes insignificant, hence will be dropped. Then the equation for I becomes

$$A_1 R_1^2 + \frac{bh^3}{12} + A_3 R^2, \text{ etc.}$$

Substituting the correct values

$$I = (4.26 \times 5.67^2) + \frac{.625 \times 11.25^3}{12} + \text{etc.} = 632.17$$

$Z = \frac{I}{C}$, in which C = distance from outermost fiber to center

of gravity of the section, which as found above is 6.89 in. Therefore $Z = 632.17 \div 6.89 = 91$. But since only one-half of the section *G—G* was taken for convenience of calculation, the total $Z = 91 \times 2 = 182$, which compared with the required Z of 161.5, shows the section to be amply large, but not too large, as the actual fiber stress would then be only 8,873 lbs., which is not too small for steel castings.

The required section modulus for all other sections between *G—G* and *A—A* may be calculated in the same manner as was that for section *G—G*. But a much easier and shorter method may be used for section *H—H*, as it is a hollow rectangle and there has been devised a universal expression for the section modulus of a hollow rectangle, which is

$$Z = \frac{bh^3 - b_1 h_1^3}{6h}$$

In which b = outside width, h = outside height, b_1 = inside width, h_1 = inside height. Substituting the values assumed for section *H—H*,

$$Z = \frac{12.75 \times 6.75^3 - 11.5 \times 5.5^3}{6 \times 6.75} = 52.0$$

which is slightly larger than 47.4 the required amount. By the methods above described, the sections at *A*, *B*, *C*, *D*, etc., were found and the bolster drawn to conform to those sections as shown in Fig. 2.

In making an actual working drawing such fillets and beads as it is deemed necessary to have for good foundry practice should be added, which would only increase the strength of the bolster to that extent, but not to a sufficient amount to justify complicating the calculations by considering them. The $\frac{I}{C}$ as found for each section was plotted as shown in Fig. 2. It is evident from the relative position of the $\frac{M}{f}$ curve and the $\frac{I}{C}$ curve that the bolster as designed fully meets the requirements for strength.

The bolster must be investigated for one other force, however, and that is for the transverse load of 19,000 lbs., which is assumed to be taken by the top section of the bolster. The bolster will be considered as a simple beam with a concentrated load of 19,000 lbs. applied at the center. The maximum moment will occur at the center and is expressed thus, $M = \frac{WL}{4}$, in which $W = 19{,}000$ and $L = 76$ in., and $M = 361{,}000$. Using a fiber stress of 12,000 lbs., the required $Z = 30$. The section modulus of the top section of the bolster just to one side of the king pin hole is 28.6, which is slightly smaller than required, but the extra metal due to the center plate and flanges will more than compensate for this, so the bolster is deemed entirely strong enough for the transverse load.

The bolster having thus been designed, to meet the requirements put upon it by the loads mentioned, all that now remains to be done is to put on the center plate, side bearings, etc., as needed, so as to conform to good practice, as shown on the drawing.

TRUCK SIDE FRAME.

The cast steel side frame was designed to carry one-half the load on the bolster, which amount was 42,500 lbs. This load is transmitted to the side frames through the bolster springs. The side frame was considered as a truss receiving the load at the two columns.

An assumed side frame, as shown in Fig. 3, was drawn and the centers of gravity of its several sections were found. Through the centers of gravity of the sections, lines *r—s*, *O—p* and *m—n* were drawn, thus giving the theoretical outline of the side frame. The truss diagram was then constructed by drawing lines *AF*, *GF*, *BF*, etc., parallel to *op*, *rs*, and *mn* respectively, thus forming the closed truss diagram as shown. The arrow heads indicate the character of the stress in each member of the truss.

In constructing the stress diagram, it was assumed that each support would at times take two-thirds of the load on the side frame due to disarrangement of the bolster or the springs. For the side frame in question, this would amount to approximately 28,000 lbs., hence on *ag* and *ad*, 28,000 lbs. were laid off to a scale of 10,000 lbs. to the inch. Then *gf* was drawn parallel to *F—G*, *af* to AF_1, etc., thus completing the stress diagram. The stress in each member was then obtained by measuring the several lines in the stress diagram and making the proper deductions. The values thus found are shown in the

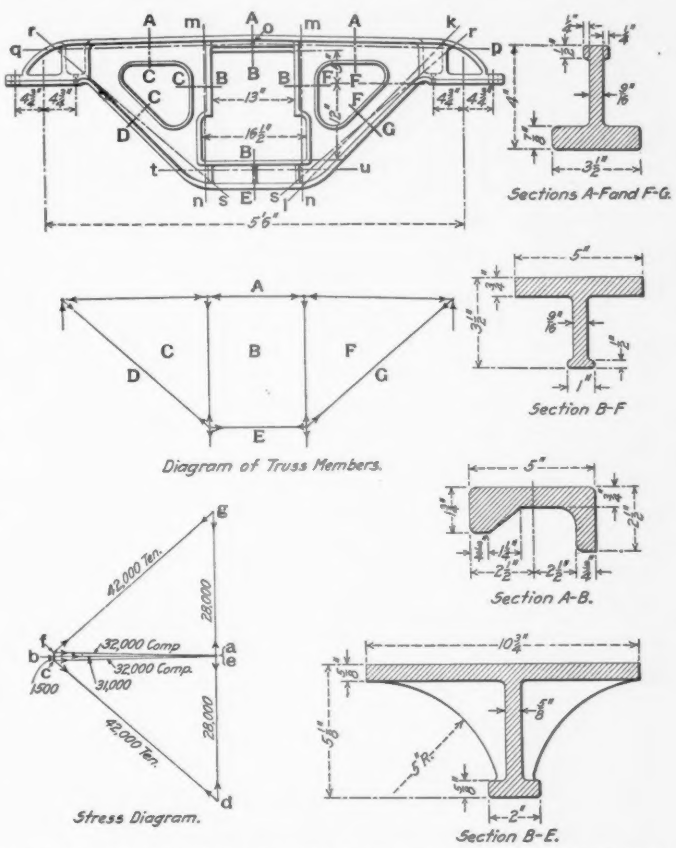


Fig. 3—Cast Steel Truck Side Frame and Graphical Method of Designing.

diagram. The sections were determined by making use of the formula: $W = fA$, in which

W = the load in pounds on the members.
f = fiber stress, which should not exceed 10,000 lbs.
A = area of section in square inches.

Apply the above to section *A—B*. From stress diagram $W = 31{,}000$ lbs. $A = 6.31$ sq. in. from the assumed section shown in Fig. 3. Therefore,

$$f = \frac{W}{A} = \frac{31{,}000}{6.31} = 4{,}900$$

which indicates that the area of section *AB* is too large, which would be true, if the direct loading were all that came upon it, but the side frame gets a transverse load similar to the bolster and it is usually assumed that the top section will take this load, hence by the time this is considered, the section *AB* will not be too heavy. In like manner, sections *AF*, *AC*, *CD* and *FG* were found.

In designing sections *BF* and *BC* of the columns, an additional force other than the direct tensional force must be considered. In the bolster design, it was found that there was a transverse load of 19,000 lbs., one-half of which amount one column on each side of the truck will take. This load of 9,500 lbs. is assumed to be applied at the vertical center of the col-

umn, the column being considered as a free beam with a concentrated load at the center. Use the bending moment formula,

$$M = \frac{WL}{8}, \text{ in which } W = 9{,}500 \text{ lbs.}$$
$$L = 16 \text{ in., the distance between supports.}$$

Substituting and solving, a moment of 19,000 lbs. is obtained. By use of the formula $M = fZ$, the desired section modulus was found to be 2.8, giving a fiber stress of 6,785 lbs. per square inch. Since the tensional stress obtained from the stress diagram is so small, it may be disregarded.

The member *BE* which forms a seat for the springs and receives the load directly from the springs must be designed as a beam. Some designers consider it a free beam, uniformly loaded; others, a fixed beam with two concentrated loads 5⅝ in. apart; but the writer has always designed it as a fixed beam with a uniform load. The member figured by the latter assumption gives a slightly larger section than the second method mentioned and somewhat smaller when figured by the first method. As a fixed beam uniformly loaded the moment

$$M = \frac{WL}{12}, \text{ in which } W = \text{the load in lbs.} = 42{,}500$$
$$L = \text{length of span in inches} = 16 \text{ in.}$$

Substituting and solving, a moment of 57,000 in. lbs. is obtained.

The modulus of the section was found to be 8.8. This was obtained in the same manner as was the section modulus for the bolster, so no explanation is necessary here.

Substituting the values for M and Z in the formula $M = fZ$, and solving for f, it was found to be 6,477. In addition to the stress due to the bending moment, this member has a tensional force of 31,000 lbs. acting upon it, as obtained from the stress diagram. This tensional force divided by the area of the section 10.3 in., gives a fiber stress of 3,000 inch pounds, which when added to the fiber stress due to the bending moment makes a total fiber stress on the section of 9,477 inch pounds.

The value of the area of each section and the fiber stress imposed by the load on the side frame is given in the following table:

Section	AB	AF	AC	FG	BF	BE	BC	DC
Area	6.31	4.33	4.33	4.33	5.37	10.3	5.37	4.33
Fiber stress	4,900	7,400	7,400	9,700	6,785	9,477	6,785	9,700

UNDERFRAME.

The underframe of an ordinary steel gondola car may be either of two general types, one having two side sills and a center sill, and the other having only a center sill, the load being transmitted thereto by heavy cross-carriers. As the majority of cars have both side and center sills, that type will be used in this design.

It will be assumed that the load will be uniformly distributed over the floor of the car. The uniformly distributed load for the 100,000 lb. car may be taken as follows: Light weight of car body without trucks, 28,000 lbs.; 100,000 lbs. the rated capacity plus 10 per cent. for overloading gives a total of 110,000 lbs. For the car body and the loading there is 138,000 lbs., to which add 20 per cent. for oscillation, making the total uniformly distributed load 165,600 lbs. This divided by the square inches of floor space (the floor being 9½ ft. x 42 ft.) gives 2.88 lbs. per square inch of floor space. Each side sill will support one-half the floor width between it and the adjacent member of the center sill, which for the car in question is 25¼ in. Each member of the center sill will also support 25¼ in. width of floor space plus one-half of that between the two members, which is 6½ in. The width of floor space carried by each member of the center sill is therefore 31¾ in.

Center Sill.—The center sill must be designed to provide for two different stresses, that due to the uniformly distributed

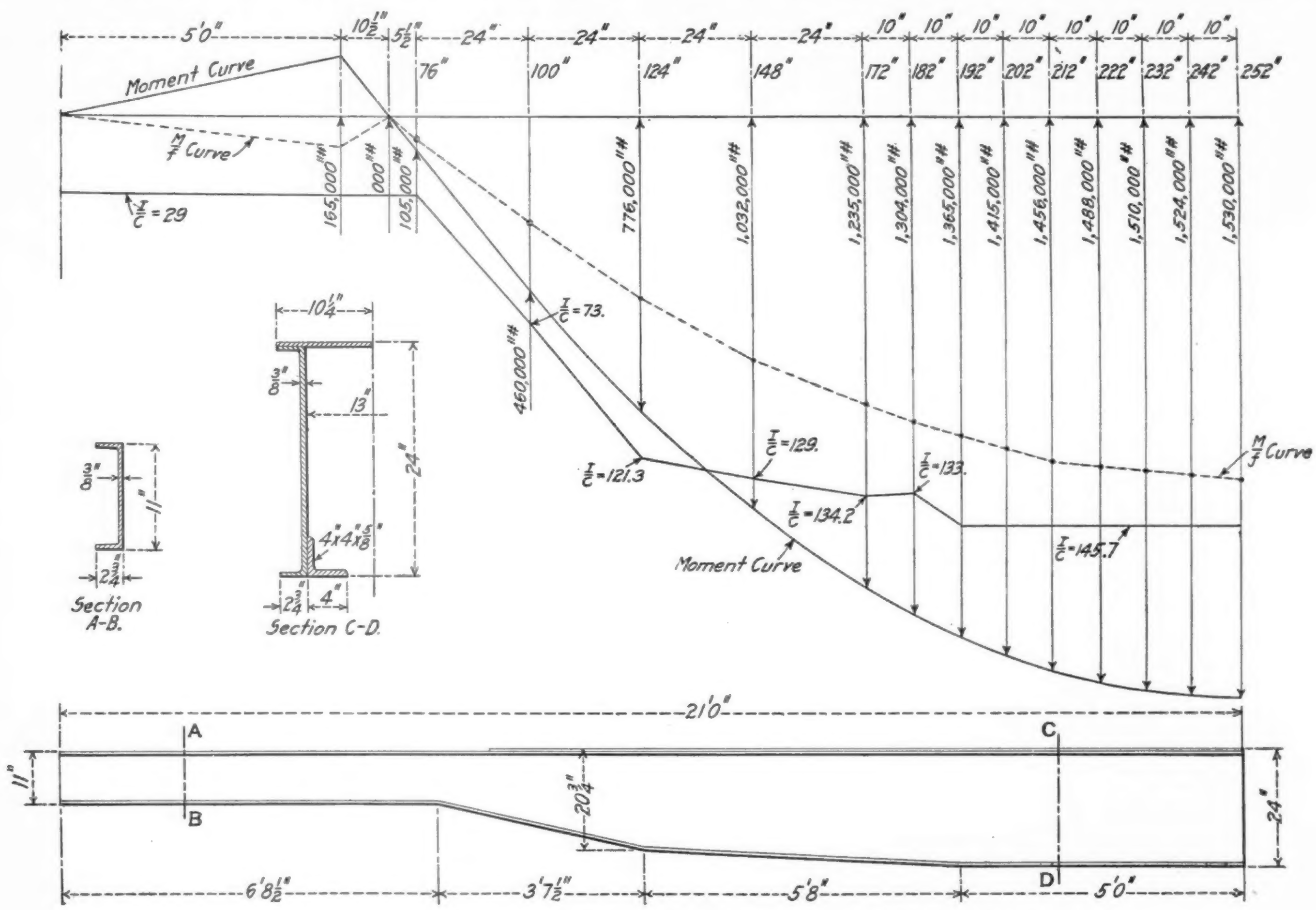


Fig. 4—Graphical Method of Designing a Center Sill for a 50-Ton Gondola Car.

load and that due to buffing, which will be taken as 200,000 lbs. The stress in the sill due to buffing is $\frac{B}{A}$, where B is the buffing force, and A is the area of the section. The stress due to the bending moment is $\frac{M}{Z}$, where M is the bending moment and Z the section modulus. Then if from 12,000 lbs. to 15,000 lbs. be taken as the minimum and maximum allowable fiber stress $\frac{B}{A} + \frac{M}{Z}$ must come within these limits. The proper section can then be determined by trial.

By using the following two formulae, the bending moments at the several points indicated on the stress diagram, Fig. 4, were determined. The moment at the bolster is expressed thus:

$$M_b = \frac{WL^2}{2}, \text{ where } W = \text{load per lineal inch on the member.}$$

L = distance from the end of the beam to the point of support at the bolster, which is 60 in.

The moment at any point between the supports is expressed thus,

$$M_x = R\ (x - b) - \frac{WX^2}{2}, \text{ in which } M_x = \text{the moment at any point, } X.$$

R = the reaction in pounds.
X = Distance in inches from the end of the beam to the point under consideration.
L = Distance from end of the beam to the point of support.
W = Load per lineal inch of the beam.

Since there are 2.88 lbs. per square inch of floor area, and since each member of the center sill supports a floor width of 31¾ in., therefore, for each inch of length, there will be a load of $2.88 \times 31\frac{3}{4} = 92$ lbs. per lineal inch.

For convenience of calculation only one-half of the center section about the vertical axis will be considered. (Section is symmetrical.) The different moments may now be found. At the bolster

$$M_b = \frac{WL^2}{2} = \frac{92 \times 60^2}{2} = 165{,}600$$

The moment at any point as:

$$M_{232} = R\ (x - b) - \frac{WX^2}{2}$$

Since the beam is symmetrically loaded, the reactions at the points of support are equal, and equal to one-half the total load on the member, or 23,184 lbs. All of the factors in the above formula being known, the moment becomes

$$M_{232} = 23{,}184\ (232 - 60) - \frac{92 \times 232^2}{2} = 1{,}510{,}244$$

In this manner all of the moments shown on the diagram, Fig. 4, were obtained.

Using a fiber stress of 12,000 lbs. per square inch, the required section modulus for each point was obtained and the result plotted as the $\frac{M}{f}$ curve.

A section, as C—D, Fig. 4, was assumed and its center of gravity and section modulus determined in the same manner as was the center of gravity and section modulus of the various sections of the truck bolster, which was fully explained. As the principles involved here are identical with those of the bolster, no detailed explanation is necessary. In order to show the application of the formula $\frac{B}{A} + \frac{M}{Z} = f$, one set of calculations is here shown. Take a section 148 in. from the end of the sill having a bending moment of 1,032,000 inch pounds. This section is identical in make up to section *C—D* on Fig. 4, with the exception that the height had to be only 22 in., since the moment was less than at *C—D*. The section modulus of the 22 in. section was found to be 131, and the area 18.35 sq. in. Therefore,

$$f = \frac{100{,}000}{18.35} + \frac{1{,}032{,}000}{131} = 13{,}400$$

In like manner each of the other sections was designed. Near section 76, it was found that the cover plate could be omitted. From the center 5 ft. towards the bolster, the sill was made straight, as there was only a comparatively small change in the bending

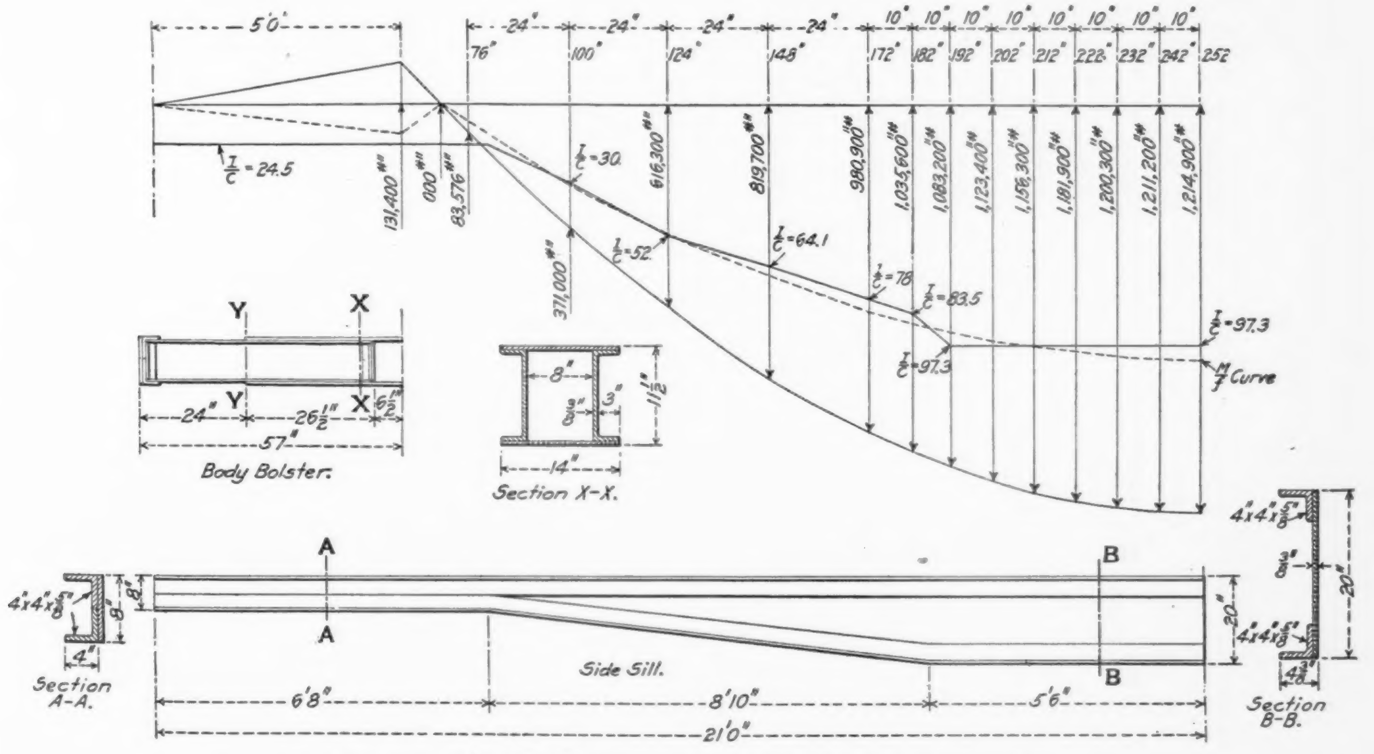


Fig. 5—Graphical Method of Designing a Side Sill for a 50-Ton Gondola Car.

moment, and also to allow for any concentration of the load that may occur at the center. The sill was also made straight a distance of 6 ft. 8½ in. from the end back towards the center. This was determined by locating a point on the moment curve, to the right of the bolster, which had the same value for the moment as required at the bolster. Thus the sill outline was determined. The section modulus or $\frac{I}{C}$ for each section as plotted was obtained by dividing the bending moment by the determined fiber stress due to the moment, which varied both above and below 12,000, that assumed for the $\frac{M}{f}$ curve. The rather large distance between the $\frac{I}{C}$ and $\frac{M}{f}$ curves indicates to what extent the actual section modulus had to be increased in order to provide for the buffing force.

Side Sill.—The stress diagram and sill design shown in Fig. 5, were determined and constructed in the same manner as they were for the center sill, there being only one exception, and that is, no buffing force was considered as coming directly on the side sills. The load per lineal inch for the side sill was 73 lbs. Since the side sill takes no buffing and carries less uniform load than either member of the center sill, it is considerably smaller in section.

The $\frac{M}{f}$ curve and the $\frac{I}{C}$ curve in Fig. 5 almost coincide. In a few instances, the $\frac{I}{C}$ curve falls above the $\frac{M}{f}$ curve, but in no instance is the fiber stress greater than 13,000 inch pounds, hence each section of the sill is sufficiently large. The construction of the side sill and its cross section is shown in detail in Fig. 5.

BODY BOLSTER.

The load of 85,000 lbs. on the body bolster was considered as uniformly distributed. The bolster acts as a cantilever beam and the distance of 48 in. between the side sill and the center sill was taken as its length. That portion between the members of the center sill being amply provided for by the cover and center plates, the greatest moment occurs at the center sill and is expressed by the following formula:

$M = \frac{WL}{2}$, in which, M = the bending moment, W = the load in pounds and L = the span in inches = 48 in. By substituting and solving, a moment of 1,009,375 inch pounds was obtained.

The moment at any other section as $Y—Y$ is equal to $\frac{WX^2}{2l}$ in which W and l are the same as in the above formula and X, the distance from the end of the bolster to the section $Y—Y$ = 24 in. The moment at $Y—Y$ was found to be 255,000.

The section modulus at $Y—Y$ is 22.3, the cover plates being omitted just to the right of the section. The fiber stress for this section is 11,400 inch pounds. The construction of the bolster in detail is clearly shown in Fig. 5. The bolster is securely fastened to the side and center sills by means of suitable angles and the top and bottom cover plates add considerably to the strength of the connection to the center sill.

OTHER DETAILS.

Having designed the principal members of the underframe as outlined, there remain a few other details that require attention. These are cross carriers, braces, side bearings, center plates and riveting. As the side and center sills have been designed of sufficient strength to take all of the loading, only such cross-carriers and braces need to be added as, in the discretion of the designer, are necessary for transverse and lateral stiffening.

The proper selection of side bearings and center plates is largely a matter of judgment and expediency, hence no particular problem of theoretical design is involved.

Spacing of Rivets.—When plates are needed in addition to the sills to carry the bending moment these must be riveted to the latter and the rivets properly spaced to receive the load coming to them. With strengthening parts riveted to both top and bottom of the sill, the spacing of the rivets can be determined by the well known formula

$p = \frac{Rh}{J}$, where

p = pitch of the rivets in inches.
R = resistance of one rivet in pounds.
h = height between centers of top and bottom rows of rivets.
J = vertical shear in pounds at the point under discussion.

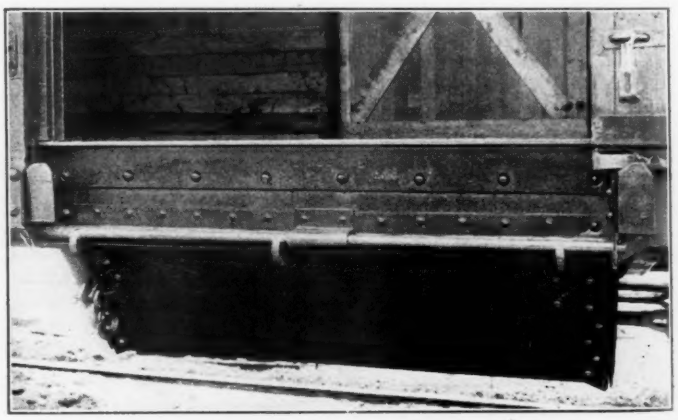
In case a single strengthening part is riveted either to the top or bottom of a sill, a different method must be employed to determine the rivet spacing.

From the method given, the theoretical spacing of the rivets can be found, but a rule in practice provides that the maximum spacing of rivets, to prevent buckling of the plate, be not more than 16 times the thickness of the plate. In case the formulae referred to give a greater spacing than 16 times the thickness of the plate, then the thickness of the plate must determine the pitch. These considerations will determine the spacing of the rivets, excepting at the extreme end of plate where two or three rivets are placed as close as practicable to take the initial stress in the plate.

BOX CAR FOR GRAIN AND COAL TRAFFIC

The construction of a suitable grain door has always been one of the most difficult problems in car design. A grain door should hold grain as securely as any other part of the car body, should be immediately available when required, should not be demolished in unloading, nor obstruct or decrease the lading room when not in use, and should be of reasonable first cost and low cost of maintenance.

With the end in view of meeting these requirements the Canadian Pacific has built 200 Burnett hopper bottom grain cars,

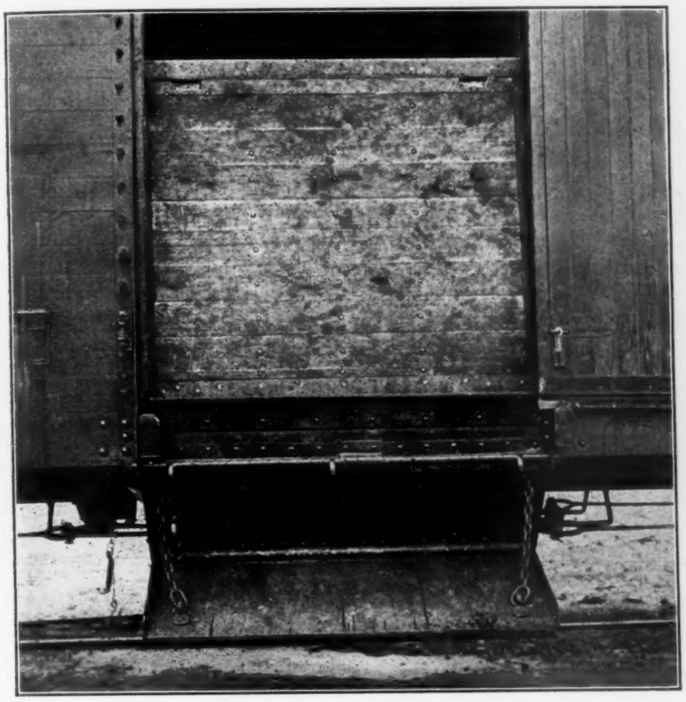


Exterior of Hopper with Door Closed; Canadian Pacific Box Car.

similar to the one shown in the illustrations, which embody several new features. The hinge of the hopper door is made by interlocking the edge of the door and the car floor, making a continuous hinge which, instead of weakening the edge, strengthens it as would the application of an angle, and the load always has a tendency to tighten the joint. The hopper door also differs from previous designs in that it is hinged at the bottom and is almost vertical; it has no closing shaft but is closed by hand and secured by a shaft having projections which engage the edge of the door at different points. The ends of the doors

have flanges which enter pockets or grooves formed by plates on the ends of the hopper. The grain doors are formed by sections of the floor at the doorway folding against the door posts. These doors are thoroughly reinforced and should be easily maintained in good condition. The whole construction is simple and strong, and as the hoppers are not subject to corrosion to the same extent as those of open coal cars, they should, excluding damage in wrecks, last the life of the car. In building the cars, each hopper is filled with flaxseed, which is then hammered and each hopper is made absolutely tight under this test; it is claimed that this is the most severe test possible with the exception of water.

One of the principal reasons for the development of this car was to secure one which would be suitable for carrying coal in one direction and grain in the other, avoiding to a large extent empty mileage and the hauling of other cars for coal, particularly



Exterior of Canadian Pacific Box Car with Hopper Open and Grain Door in Place.

Interior of Canadian Pacific Box Car Showing Grain Door and One Open Hopper.

Hopper Bottom Box Car for Grain and Coal Traffic.

anthracite. In dumping grain the same elevator arrangement is used as with the ordinary car. To unload a car of grain, the pin which holds the clamping shaft handle is driven out, which allows the hopper door to open and about 50 per cent. of the load runs out almost as fast as the elevator can take it away; the floor door is then unlatched and pushed down and the remainder of the load is taken out through the side doors in the usual manner. It has been found that the employment of this method saves about one-third of the time which it ordinarily takes to unload a box car.

The hopper door arrangement increases the weight of the car about 800 lbs. compared with a car not fitted with grain door equipment, but when compared with a car fitted in the ordinary way for grain traffic this difference is reduced by the weight of the grain door and fittings. The cost of maintenance of the ordinary door and fittings, including the usual nailing strips on the door posts, has been estimated at from $6 per car per year upward, which is eliminated in the hopper bottom car. The additional cost of applying the hopper bottom and folding grain doors is approximately $50.00 per car. Where ordinary grain doors are used a force of men is engaged at elevators in removing nails from the door posts and inside lining and getting the cars ready for load, while with the hopper bottom car this force, as well as the shipping of temporary grain doors back to the point of loading, is almost entirely done away with, thus effecting an additional saving.

Short sections of Z-bars are applied on the inside of the door posts above the folding grain doors so that when the lading extends to a point higher than the folding doors, boards can be dropped into the slots thus formed and the load carried to any desired height.

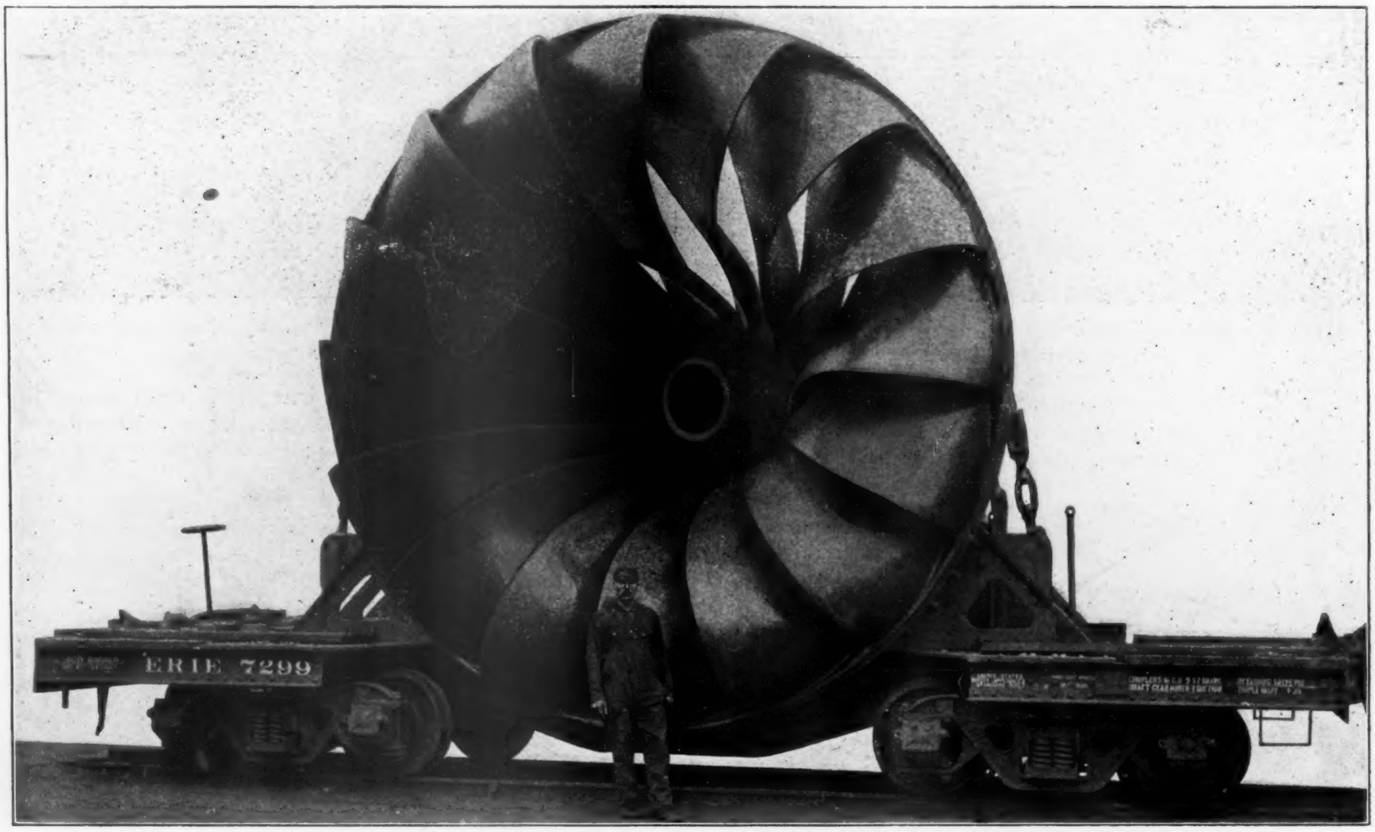
These cars are giving excellent satisfaction in service and are sought by the elevator men in preference to other cars. The hopper and grain door arrangement is the invention of R. W. Burnett, general master car builder, Canadian Pacific, and is being patented by him.

SPECIAL 75-TON FLAT CAR

BY R. S. MOUNCE.

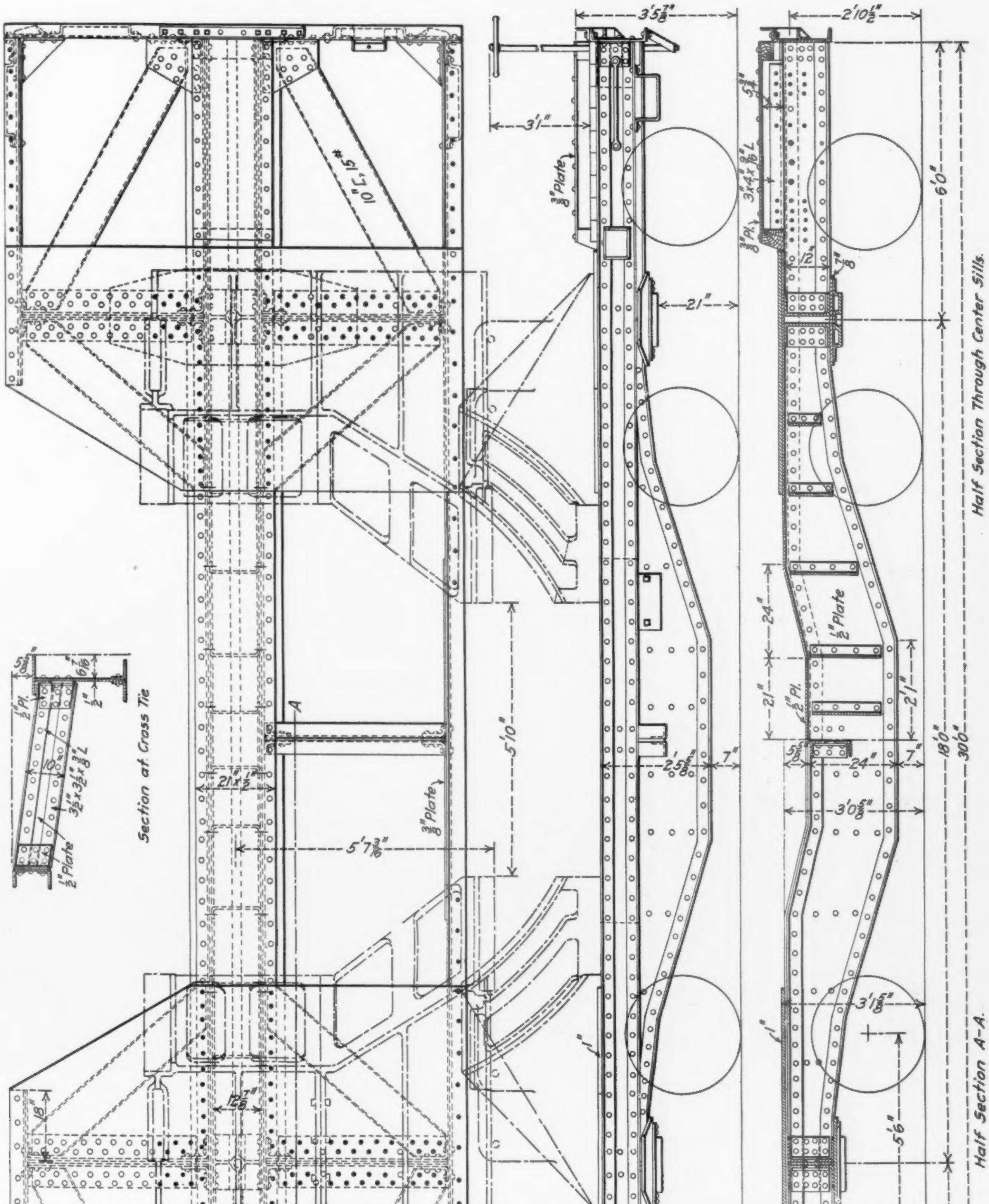
During the summer of 1911 the Erie Railroad was called upon to construct a special flat car, to be used by the Wellman-Seaver-Morgan Company, Cleveland, Ohio, for shipping several very large water turbine wheels from their plant at Akron, Ohio, to Keokuk, Iowa, where a power plant of over 230,000 k. w. capacity, obtaining its energy from the Mississippi river, is being constructed.

The problem was of a most unusual nature and required much careful study; first, because of the great weight of the load to be carried; and second, because its size and shape were such that it was very difficult to keep within the clearance limits, both for height and width of the roads over which it would have to be carried, namely, the Erie, E. J. & E., C. B. & Q., and T. P. & W. The turbine wheels are 11 ft. 2½ in. long, 16 ft. 2 in. in diameter at the large end, 12 ft. 8 in. in diameter at the small end and weigh about 130,000 lbs. The clearances on C. B. & Q. bridge gussets required the lowest point of the turbine wheel to be 16 in. above the rail, which brought the highest point 17 ft. 6 in. above the rail. The clearances at the sides were not over 1¾ in., and at the top and bottom not more than 1 in., so it can be seen that the utmost care had to be exercised in designing the car in order that no trouble would be encountered during transit.



75-Ton Flat Car for Transporting Turbine Wheels 16 ft. 2 in. in Diameter.

A special flat car, all-steel with the exception of a few floor boards, was designed to meet the conditions imposed. In order to locate the turbine wheel supporting saddles comparatively low, it was also necessary to have the floor of the car quite low, which required the use of wheels 30 in. in diameter. The car was made as short as possible, in order to bring the point of application of the load very close to the body bolsters. It is 30 ft. long over end sills, with four-wheeled steel side frame trucks, having 6½ in. x 12 in. journals and Davis cast steel wheels;

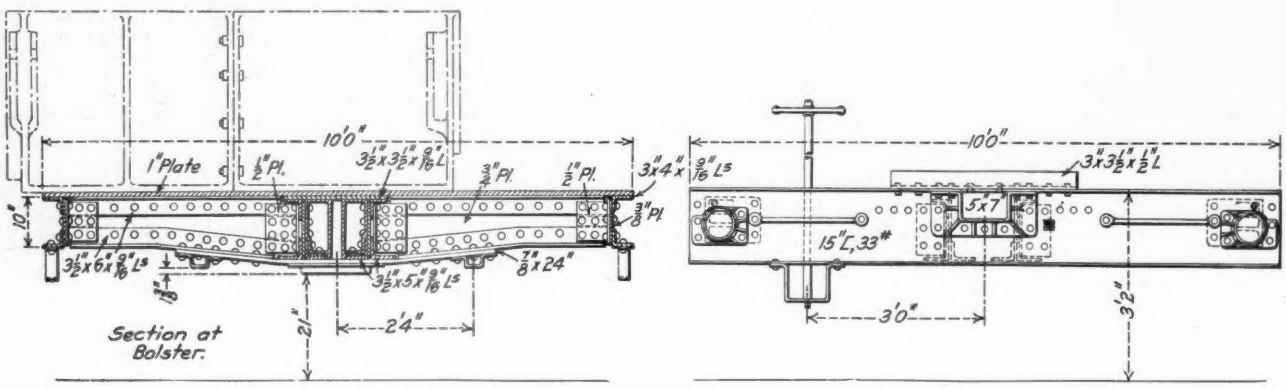


Special 75-Ton Flat Car Built by the Erie Railroad for Transporting Large Turbine Wheels.

the trucks have a 5 ft. 6 in. wheel base and are spaced 18 ft. between centers. The car weighs 54,100 lbs., and will safely carry a load of 75 tons.

The illustrations clearly show the construction of the car. The center sill, which carries practically all the load except that portion transmitted to the one side sill, or to the body bolsters at one or the other end of the supporting saddles, is of particularly rugged construction. It is of the fish-belly built-up type, 11½ in. deep at the bolsters and 23 in. deep at the center, where the top is offset 5⅝ in., and the bottom comes within 6 in. of the top of the rail. The center sill web plates are of ½ in. steel plate reinforced at the top by a 3½ in. x 3½ in. x 9/16 in., 12.4 lbs. angle and at the bottom by similar angles, one inside and one outside. There is a ½ in. cover plate extending over nearly the entire length of the center sill. In addition to this, there are ten stiffeners of channel shape extending between the web plates. There is but one continuous side sill, the other being cut away for a length of 7½ ft. on each side of the center to provide space for the large end of the turbine wheel. These are made of built-up channels of 9 in. x ⅜ in. plate, with 3 in. x 4 in. x 9/16 in. angles at top and bottom.

The body bolsters are also of the built-up type, I-beam section. They have ¾ in. web plates with 3½ in. x 6 in. x 9/16 in., 17.1 lbs., angles at top and bottom. Each bolster has a ⅞ in. bottom cover plate. The top cover plates, serving as supports for the saddle castings, are 1 in. thick; their great width and method of fastening to the center sills, side sills and body bolsters ties them all rigidly together, thereby largely compensating for the strength and stiffness lost by cutting away the central portion of one side sill. In addition to this bracing, the continuous side sill is tied to the center sill by a crosstie of built-up I-beam section.



Cross-Section and End View of Special 75-Ton Erie Flat Car.

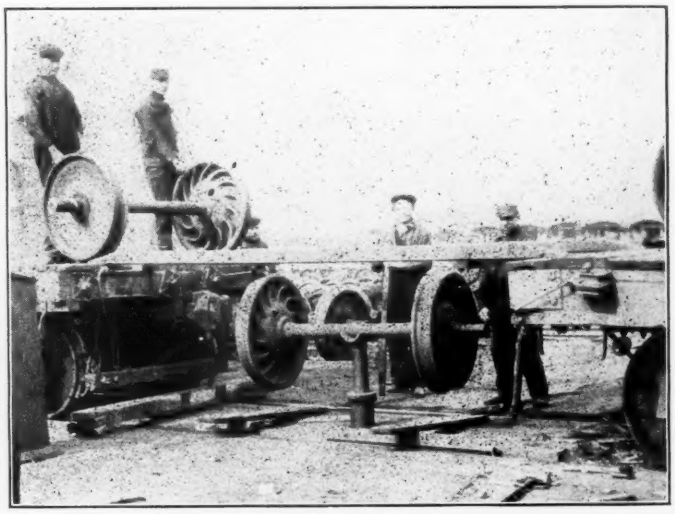
There are four diagonal braces at each end of the car, connecting the ends of the body bolsters to the center sills on one side and to the junction points of the end sills and the center sills on the other. These braces are made of 10 in. 15 lb. channels, and add considerably to the rigidity of the structure as a whole.

The saddles consist of two pairs of steel castings, cast right and left, two on each side being bolted together. These are carefully machined to fit the contour of the turbine wheel, so that there will be no tendency for it to slip during transit. They are provided with lugs at each end for attaching tie straps with which to securely clamp the turbine wheel into place for shipment.

The car was ready for service in June, 1912, and several of the turbine wheels have already been successfully carried to their destination. The outcome of this unusual problem has brought much satisfaction to those who were concerned in the design and construction of this car and it reflects considerable credit upon the Erie Railroad for so readily co-operating with the Wellman-Seaver-Morgan Company in handling its large and important contract.

UNLOADING CAR WHEELS

At the Forty-second avenue shops of the Chicago & North Western at Chicago, car wheels are repaired and renewed for the whole system. They are received in carload lots and the illustration shows the method employed in unloading. A car


Unloading Car Wheels at Chicago & North Western Shops.

is spotted each side of the air jack, as shown, and the wheels are rolled from the flat cars on the two stringers laid between the cars. They are then lifted by the jack and turned so that they will pass between the stringers. With this arrangement 80 pairs of wheels can be handled in about an hour.

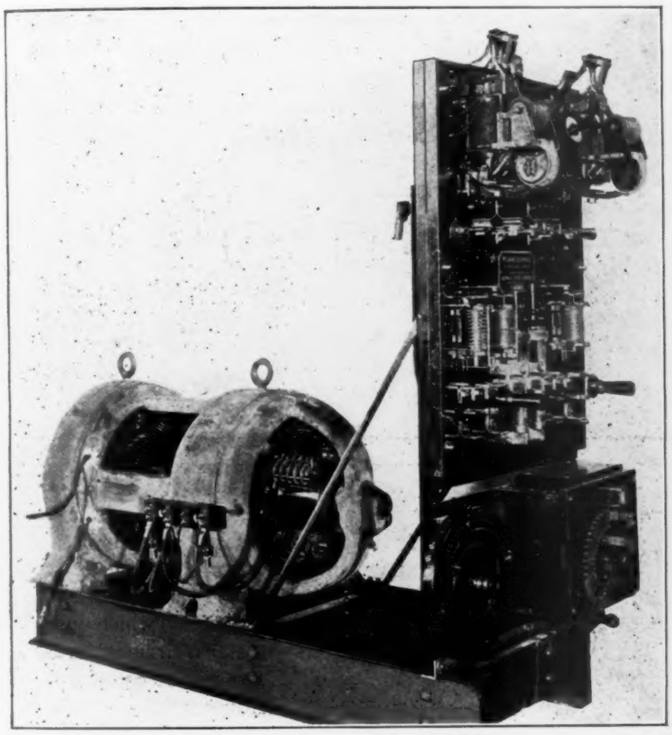
Railway in Alaska.—Special despatches from Washington say that the bill, or one of the bills, for the construction by the government of a railroad in Alaska, is to be urged for early passage in Congress, and that President Wilson has in a general way approved the project. The bill in its present shape will put the control of this enterprise in the hands of the president, the committee having cut out the provision for a special commission. The amount of bonds authorized to be issued, as now stated in the bill, is $40,000,000.

Penalties for Trespassers.—A. W. Smallen, chairman of the general safety committee of the Chicago, Milwaukee & St. Paul, has addressed a petition to the municipal court judges of Chicago, asking them to impose penalties on all trespassers brought before the courts. With the petition was a statement showing the number of persons killed while trespassing on railway tracks during the past 20 years, and a comparison of the number of trespassers killed and injured, and passengers and employees killed and injured during the year 1912.

NEW DEVICES

ELECTRIC ARC WELDING

Both the oxy-acetylene and electric welding systems are now in quite general use in railroad shops, the gas system being



Portable 300 Ampere Multiple Unit Welding Outfit.

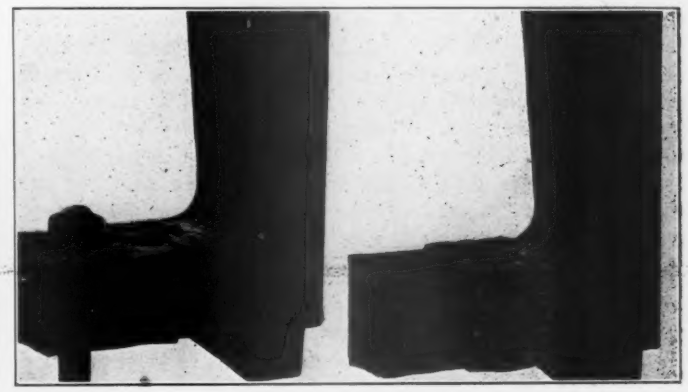
preferred for certain work while for other work the electric system is preferred.

Graphite Electrode Holder and Hand Shield.

Among the important features which are claimed for the electric arc system are its intense heat, which is about 4,000 deg. C., ease of manipulation, cheapness and safety. The operation of the electric arc for producing high temperature is quite simple and it has been in use for many years. The work which is to be repaired is generally connected with one wire from the electric circuit while the other wire is connected to an electrode in the

Operator Using Metallic Electrode.

hands of the operator. The electrode is then brought into contact with the work and the circuit established, when it is removed a slight distance and forms an arc. The operator then moves the electrode over the work wherever it may be necessary



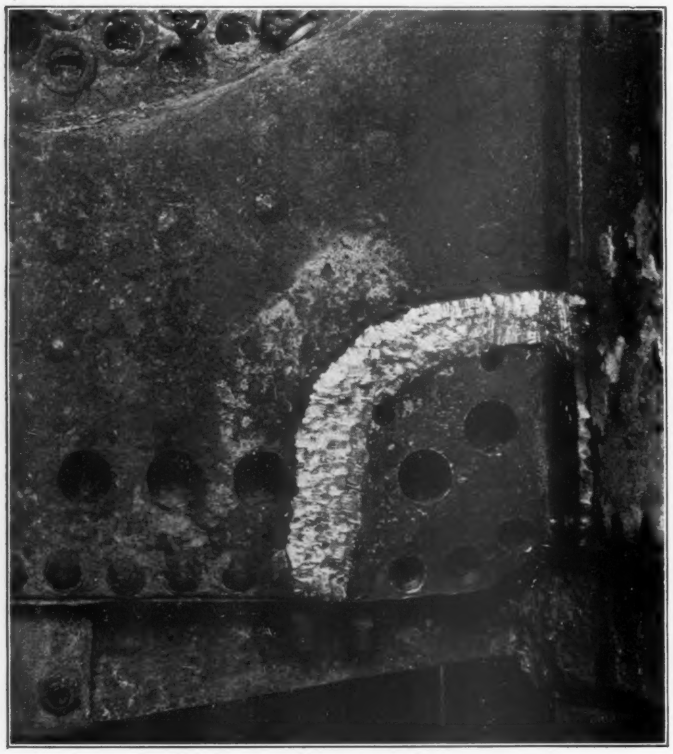
Broken Lower Frame Rail Before and After Welding.

and the arc follows, so that the heat may be concentrated or spread over an area, whichever is desired. A potential of from 10 to 60 volts is required at the arc, and if this voltage is obtained by the introduction of resistance in series with the existing shop circuits there will be considerable waste; and further, unless means are provided for maintaining the proper

potential and protecting the line against short circuits, it is impracticable to do electric welding from the regular shop circuit.

In order to overcome these difficulties the C. & C. Electric & Manufacturing Company, Garwood, N. J., has developed a special motor-generator set for electric welding. This set, with its automatic controlling apparatus, provides a means of readily changing the shop circuit, whether it is alternating or direct current, to the voltage necessary for welding and at the same time guards against short circuiting.

In using the graphite electrode method of electric arc welding a potential of from 50 to 60 volts is required at the arc and a current of about 300 amperes. This method is applicable to welding, filling in, building up, cutting, etc., the metal for filling in or welding being supplied from an outside source, generally either a rod of soft iron or scrap metal which is fused by the arc. A lower potential is generally used with the metallic electrode. With this process the metallic electrode is itself consumed and forms the metal which is deposited on the work, so that the process has to be interrupted from time to time to permit of the operator's inserting a new electrode. This system is very generally used for side and overhead work, such as repairing cracks in locomotive fireboxes, as the metal is entirely used up and therefore does not drop on the operator. The full capacity of the machine can be used for either graphite or metallic welding.



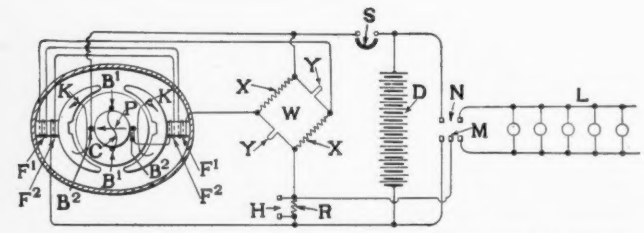
Piece Welded into Throat Sheet of Firebox.

NEW BRANCH LINE FOR INDIA.—A branch line, 8.58 miles long of the 3 ft. 3 in. gage has been sanctioned from Nidamangalam, on the South Indian Railway, to Mannargudi; to be constructed on behalf of the District Board of Tanjore.

HOLD-UP ON THE ILLINOIS CENTRAL.—The "Diamond Special" Express of the Illinois Central, northbound, was stopped by robbers about 13 miles south of Springfield, Ill., on the night of June 17, and the engineman was compelled to pull the express car some distance away from the passenger cars, where a stop was made and the express messenger was overpowered and the safe blown open.

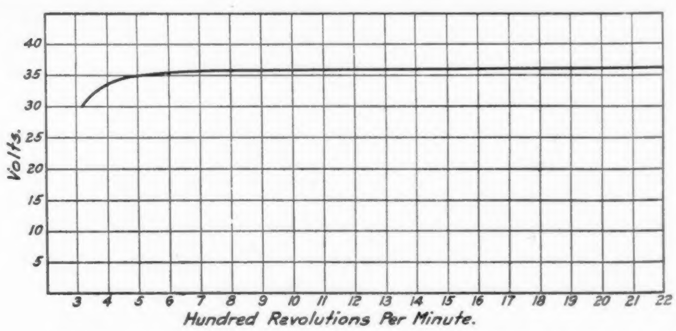
AXLE LIGHTING SYSTEM

The Atchison, Topeka & Santa Fe is introducing, after a test, an axle lighting system, which has been in process of development by the Electric Storage Battery Company, Philadelphia, Pa., for a number of years. It automatically adjusts the output of the dynamo to the requirements of the service, and gives the battery the slight amount of overcharge required to keep it practically full and in good condition, but no more, producing conditions of operation ideal for maximum battery life. Should the battery become discharged by a prolonged stop with the lamp load on, its charge will be rapidly restored during the subsequent run. Should the car be transferred from a daylight run to one requiring considerable artificial lighting, the output of the dynamo will increase to meet the changed conditions of service. This is all accomplished automatically without manual adjustment of any kind.



Wiring Diagram for Electric Storage Battery Axle Lighting System.

The dynamo is of the Rosenberg type, which has been used abroad in axle lighting for a number of years, but has been redesigned to operate in connection with a constant voltage regulator. Current in the primary field winding F^1 produces a small primary field flux represented by the arrow P, which induces a small electromotive force between the short circuited brushes B^1 and a flow of current through the short circuit connection C. This current, flowing through the armature winding, produces by armature reaction the secondary or principal field flux, which does not pass through the frame of the machine, but is confined to the heavy pole shoes and the armature as shown by the arrows K. This latter flux produces the electromotive force at the principal brushes B^2, which are connected to the external circuit, a series field winding F^2 in this circuit serving to balance the armature reaction due to load. An important advantage of this type of machine lies in the fact that it generates the same polarity with either direction of rotation, thus requiring no pole changer.



Speed-Voltage Characteristics of Axle Lighting Dynamo.

The primary field winding F^1 is connected across opposite junction points of the Wheatstone bridge W, the other two junction points being connected respectively to the positive and negative terminals of the machine. This bridge is designed to give the constant voltage characteristics above mentioned. It includes fixed resistances X in opposite branches and iron wire ballasts Y in the other two branches. The latter, on account of their high temperature coefficient, have a practically constant

current characteristic under operating conditions. This combination of circuits produces a field excitation continually diminishing with increase of speed. The resulting speed voltage characteristic of the dynamo is shown in one of the illustrations.

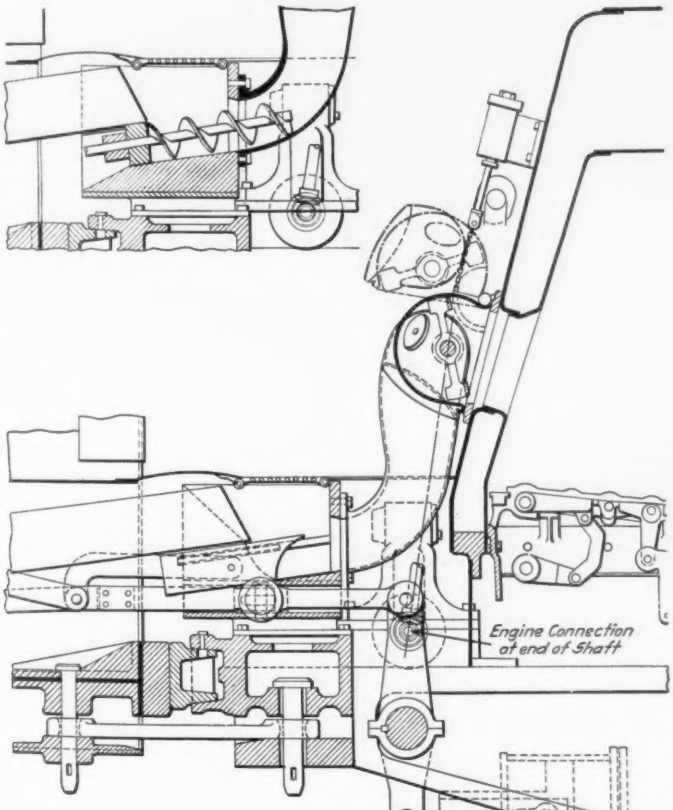
An automatic switch *S* connects the dynamo to the battery *D* when the voltage of the former is slightly above that of the latter and opens when the output of the dynamo drops to zero. The knife switch *N* connects the lamp circuit *L* to the battery.

The voltage of the dynamo is fixed at a point slightly above the floating voltage of the cells, thus insuring that the battery is always fully charged. The difference between this voltage and that of the battery on discharge is, however, so small and the change from one to the other so gradual that no lamp regulator is required.

Should it ever be found necessary to give the battery a high voltage charge, this may be done during a daylight run by means of the fixed resistance *R*, normally short circuited by the switch *H* and also by the clip *M* on the main lamp switch. When both of these switches are open, the voltage of the dynamo is raised by an amount determined by the value of the resistance *R*. Whenever lights are required, the closing of the lamp switch *N* short circuits the resistance R, reducing the voltage to normal, and eliminating the possibility of excessive voltage at the lamps. During five months of continuous operation of a demonstration equipment, no occasion for such a high voltage charge has arisen.

HERVEY STOKER

The Hervey stoker, which is of the top feed or scatter type, has been in use on a Mikado type locomotive on the Baltimore & Ohio between Philadelphia and Baltimore, making a total of



Application of the Hervey Locomotive Stoker with the Crawford Conveyor.

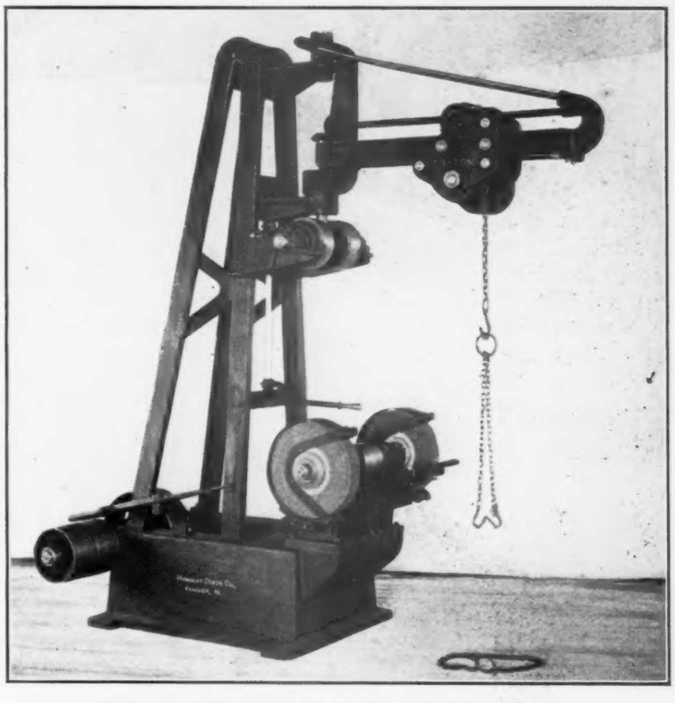
6,500 miles. The most noticeable feature about it is the distributor, which is constructed like a fan. In order to properly distribute the coal to all parts of the firebox the blades of the distributor are so deflected as to deliver the fuel first to one side and then to the other. This distributor is so arranged in its casings that it may be swung out of the way in case it is necessary to resort to hand firing.

The coal may be delivered to the distributor either from above or below. The illustration shows an application of the Hervey stoker to a Pennsylvania Lines locomotive in connection with the Crawford tender feed arrangement. A special type of screw conveyor is employed in this case and is shown in the small view. A seven horse power steam engine is used to drive both the conveyor and the distributor, this being accomplished through the use of bevel gears. In this application the screw conveyor passes the coal up through the feed passage to the distributor. This stoker was invented and patented by D. F. Hervey, Logansport, Indiana.

CRANE-GRINDER

It is frequently necessary to do more or less grinding on large castings, forgings or plates and it is not an uncommon sight to see two or three men holding a piece that is being ground. For such cases, a moderate size crane or hoist over a grinder has very evident advantages and the Mummert-Dixon Company, Hanover, Pa., has designed a machine of this kind.

This tool is shown in the illustration and has a substantial base, at one end of which is mounted a double grinding wheel driven by a pulley between the wheels. At the rear of the base is a suitable frame consisting of channels properly formed and



Grinder with One-Ton Crane and Power Hoist.

braced, to which are secured the brackets carrying the swinging arm. The crane arm itself swings on two trunnions and is free to move for more than a half circle. The one-ton trolley has a free movement in and out on the jib and the hoist is driven through the medium of the square shaft seen just over the runway. Connection is made by bevel gears, through the lower trunnion to a shaft which carries two pulleys. These are belted to the main driving shaft, one belt being straight and the other crossed. Between the two pulleys is a clutch operated by a lever handle near the wheels. When this lever is thrown in one direction it engages the lifting clutch and when thrown in the other it engages the lowering clutch. In the central position it is neutral. Provision is also made for operating the hoist by

hand, if desired, by means of a crank handle on the end of the clutch shaft.

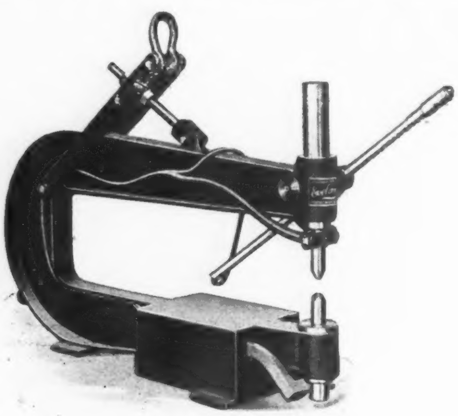
With this machine, castings or forgings of any weight up to one ton may be conveniently handled and properly ground by one man. Detachable rests are provided which may be used with the grinding wheels when lighter castings are being ground. The wheels are protected with substantial steel guards. The countershaft runs in self-oiling bearings and is so located that all belts are out of the way.

ELECTRIC RIVETING

Rivets form a most important part of the structure of locomotives and steel cars and any process that will improve the method of using them will be of interest to railroad mechanical men. The electric riveting machines which are illustrated here are suitable for riveting car and locomotive truck frames, ash pans, tool boxes, structural work, etc., and are manufactured by the Eveland Engineering & Manufacturing Company, Philadelphia, Pa.

Riveting by electric current, by heating and heading the rivets when in place, has been in successful operation in a number of factories for several years. A cold rivet is placed in position, and by pressing a lever, it is heated by electric current to any degree required, while by a suitable arrangement of levers pressure is exerted either by power or by hand and the head is formed, both the heating and heading being done in one operation. The Eveland electric riveters are made in various types and sizes, from small bench and portable machines to power driven machines, and are capable of heating and heading rivets of any material and from 1/16 in. to 2 in. in diameter.

Small Portable Electsic Riveter.



Large Type of Portable Electric Riveter.

The machines are capable of developing a temperature in excess of 2,000 deg. F., but it is claimed they are absolutely safe and that there is no possibility of an electric arc forming, nor of any danger from electric shock. The use of this process eliminates the necessity of having gas, oil, coal or coke forges to heat rivets, which makes the riveting easier and it is claimed gives better results, as a cold rivet may be handled more easily than a hot one and may be placed in position without fear that it may become cold and the head chip off. A uniform heat is obtained, expansion is uniform and when the proper degree of temperature is secured for the rivet it is headed, so that the fibers are not injured by overheating, stretching, too rapid cooling, etc. It is also claimed that the difficulty experienced when rivets are hammered until they are cold is entirely eliminated, as there is no necessity of forming the head until the rivet is at exactly the right temperature, when it is automatically headed. Calking is seldom required in this process, because the method produces a gradual heating of the rivet which swells and fills the rivet hole uniformly and fully when headed, so that inequalities in the plates are filled with the hot metal. The manufacturers state, however, that where calking is required it may be done more safely and easily if the electrically heated rivet is used on account of there being no brittleness to the rivet or head because it has not been hammered while cold, or nearly so.

Universal Electric Riveter.

The difficulties of giving a proper heat to the rivet are also overcome because the temperature may be completely controlled. If desired, the machines are arranged so that they cannot heat the rivets above 1,300 deg., or if a higher temperature is needed 1,450 deg. to 1,500 deg. may be given. The machines are made with a series of heats known as variable speeds, so that by moving a small hand switch from one point to another a greater or less degree of temperature may be instantly secured; on one heat or speed they will rivet a small rivet, while on the next speed a larger rivet may be used, each speed having a maximum size of rivet which it will handle properly. Another point upon which stress is laid is that the rivets do not become chilled by being brought into contact with the cold plates while cooling.

There is no necessity to anneal cold made rivets, as they are heated and headed in the same manner as hot made rivets. Rivet makers urge users never to leave rivets in the fire during the

dinner hour or for any long period, but the electric riveting machine may be used up to the last minute and started again instantly when the dinner hour is over, as each rivet is heated separately.

No air compressor is needed with these riveters, and it is stated that a fair average cost per 1,000 rivets for ordinary work, the cost of electric current being taken at 10 cents per k. w. hour, is from 8 cents to 10 cents per 1,000 for 5/16-in. rivets; 12 cents to 14 cents for 3/8-in. rivets; 20 cents to 25 cents for 1/2-in. and 5/8-in. rivets, and larger sizes in proportion. It is also claimed that a man and a boy will do at least four times as many rivets per day as a man, a helper and a forge boy will do with the older process; if the work is such that it can be done on bench machines one man can do it alone. The cheapest type

Base Type of Electric Riveter.

of labor can be used as there is no particular skill required.

Among the various types of these machines is a small bench machine for rivets up to 1/4 in. in diameter; a base machine for larger and heavier work and rivets up to 1/2 in. diameter; and a universal machine which will rivet at any angle and will cover a large range of sizes and shapes. The portable machines are used for boilers, etc., and are applicable to a large range of rivet diameters. The power-driven riveters are automatic in operation, being made with a motor driven, special, variable speed attachment by means of which the operator may regulate the pressure as well as the speed of operation, rapidity of heating, etc., by pressing a button. The machines may also be adapted for tempering and hardening and for heating metal for bending, etc.

RAILWAY ACCIDENT IN MACEDONIA.—On May 23 a collision occurred at a junction of the railway between Poroi and Andjista as the result of which two engines were completely ruined. The accident is said to have been due to an error either of the Bulgarian military station master at Poroi or the station master at Andjista, and it is reported that the one who was held to be responsible has been shot by order of Colonel Ivanoff, the inspector of Bulgarian railways.

INDIRECT LIGHTING ON NEW HAVEN TRAINS

Indirect electric illumination was made a feature of the two new Pullman trains recently put in service between New York City and Boston, on the New York, New Haven & Hartford. This type of illumination has previously been used in a few of the more modern private cars, but never before in a solid train. The "Alexalite" type of indirect lighting units was chosen. The exterior bowl of the fixtures is adaptable to any artistic design. The design of the three distinctive car lighting fixtures installed in the New Haven trains was a Colonial or an Adam-Colonial type, and the cars were built to harmonize with the fixtures, whereas the fixtures are usually fitted to the car. Features of the decoration are the fan shaped windows, the spindle legged chairs in the dining room, the harmonious de-

Alexalite Indirect Lighting Units.

sign of the ventilator windows and the delicate inlaid pattern in the woodwork. The floor is covered with a heavy Brussels carpet instead of the conventional green.

Three different exterior designs are carried out in the fixtures for the observation, dining and chair cars. The casing is of wrought brass cast in one piece, and the entire fixture is made solid and rigid. The diffuser basin is made of steel, coated with a durable, white porcelain enamel. The fixtures are hung so that the diffusing bowl is about 12 in. below the monitor ceiling, being spaced 6.5 ft. apart on centers and installed in a single row. No side lighting is required.

The fixtures in the observation car are equipped with three 50-watt tungsten lamps, suspended vertically above a white porcelain reflecting bowl. The other fixtures are "Monelux" and contain one 100-watt lamp. The illumination is equivalent to more than 4 ft. candles on a plane 6 in. above the arm of the chairs. The lighting fixtures used in this installation were supplied by the Central Electric Company, Chicago.

GREASE PLUG

Trouble is very commonly experienced by the grease plugs used in side rods being lost when the locomotive is in motion; lock nuts easily slack off due to the motion of the rods and the plugs then work out and drop off. The device shown in the illustration is intended to prevent this. It consists of a T-shaped piece of metal, the ends of the lower arms of which are ball shaped to fit into notches in the bushing of the plug or the top of the side rod. This T is held down by a spring in the body of the plug and when the ends of the lower arm drop into the notches

Grease Plugs Fitted with Locking Device.

the tension of the spring holds the plug firmly in place. The main arm of the T passes through a hole in the top of the plug and acts as an indicator of the amount of grease in the cup.

The device is in use on a Pennsylvania Lines consolidation type locomotive, and the one on the right in the illustration shows an application to the Pennsylvania standard grease plug. It may be applied to any plug now in use and is patented by D. F. Hervey, Logansport, Ind.

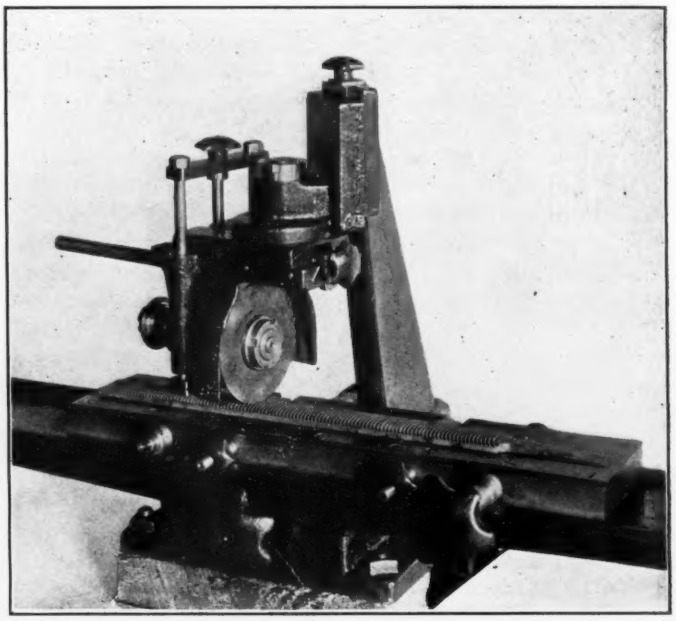
SHARPENING CURVED TOOTH FILES

Alexis Vernas, of Switzerland, invented the milled, curved tooth file in 1900, and was awarded the Elliott Cresson gold medal by the Franklin Institute of Philadelphia for his invention. This type of file has shown itself to be a decided improvement over the usual type, and it is stated that it will remove from three to five times as much metal, when compared with an ordinary bastard file.

In manufacturing these files, the teeth are cut one at a time on a milling machine; it takes about 25 minutes to mill the teeth on one 12 in. Vixen file, while an ordinary bastard file requires less than a minute for making the teeth. In as much as each tooth is sparately milled, it is possible to sharpen the curved tooth file in the same manner that a milling cutter is sharpened and a machine has been developed for this purpose.

This machine employs a fine grinding wheel, held in a frame pivoted at the proper point to give the wheel the correct arc for grinding the teeth. The moving of the wheel across the file is performed by hand, as is also the change in the position of the file for grinding the different teeth. The operation is so simple, however, that boys or even girls can run the sharpener satisfactorily.

It is stated that one of these files can be sharpened from four to six times, and in each case the file is equal to a new

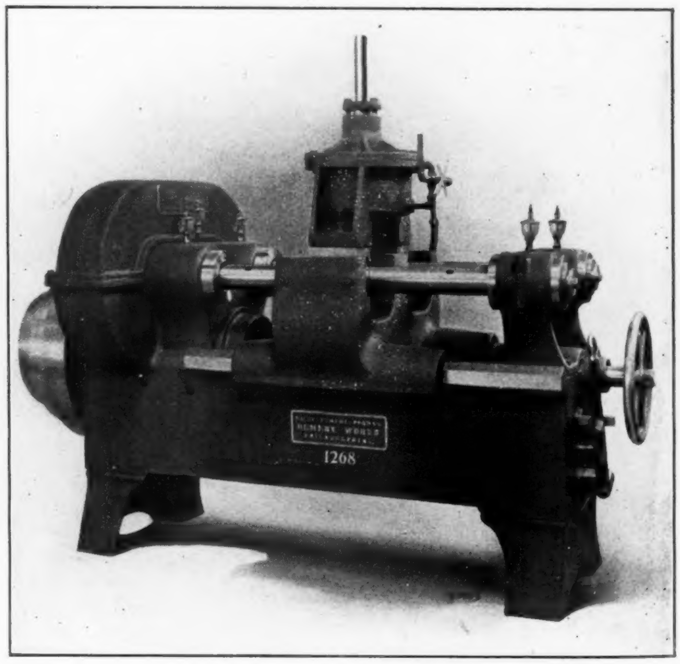


Machine for Regrinding the Teeth of a Curved Tooth File.

one. The machine was developed by the Vixen Tool Company, Philadelphia, Pa., who manufacture the Vixen file.

DOUBLE JOURNAL BEARING BORING MACHINE

The ordinary boring machines for journal bearings of the average size are too light for efficient work on the large size bearings which are now coming into more general use. Recog-



Boring Machine for Journal Bearings up to 8 in. x 15 in.

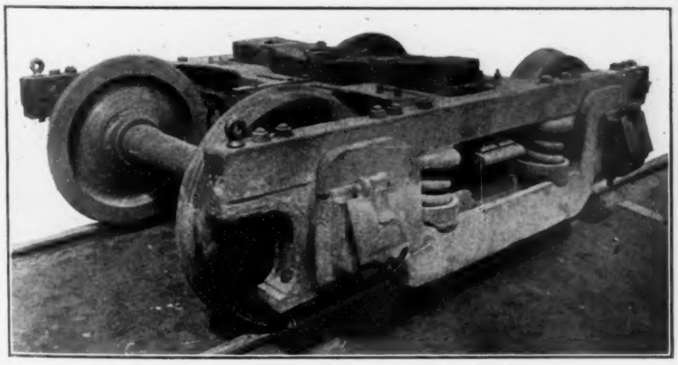
nizing the probable future demand for a more powerful machine, the Niles-Bement-Pond Company, Bement Works, Philadelphia, Pa., has perfected a double boring machine which has a capacity

for journal bearings up to 8 in. x 15 in. in size. In this machine the journals are clamped in position by a pneumatic cylinder which is so designed as to allow for a slight difference in the size of the journals on either side, and provides for very convenient and rapid removal and application of the work in the machine.

The saddle is provided with hand adjustment, automatic feed and a quick return by power. The change from power feed to rapid traverse in the reverse direction is made by one lever. A set of chucks for standard M. C. B. journal bearings is provided with the machine, but special size chucks can be used if desired. The boring mandrels are 3¾ in. in diameter and are separate from the spindle. Other sizes of mandrels may be substituted if required. The machine can be driven either by a direct connected motor or by a belt through a three-step cone pulley. Its construction is heavy throughout and the gearing is unusually large and powerful.

EQUALIZED SWING-MOTION TENDER TRUCK

A locomotive tender truck that has already proved itself to be satisfactory in service when used on high speed locomotives, has recently been perfected by the Commonwealth Steel Company, St. Louis, Mo. It is provided with a swing-motion bolster carried on three-point hangers which are so designed as to support the tender in a stable manner without responding laterally to slight track imperfections, such as low joints, etc. The truck frame, in many respects, follows the design which has been previously used by this company for four wheel passenger car trucks and combines the cross transoms and the wheel pieces in one steel casting. It is claimed that with the three-point hanger for the bolster, the impact between the wheel



Equalized Tender Truck with Swing-Motion Bolster.

flange and the rail when entering a curve at high speed is greatly reduced, this due to the fact that the cistern is lifted by the side swing of the bolster and thus tends to throw the whole truck away from the rail. This truck is equalized in practically the same manner as a passenger car truck, the wheel pieces being supported on the equalizers by large single coil springs placed as close as possible to the boxes. It will be noted that the springs supporting the bolsters are set well in toward the center, thus tending to keep all weight well inside the gage limit and defeating any tendency to lift the wheels from the rail.

FLOOD DAMAGE IN NATAL.—It is estimated that the total cost of repairing the damage done to the railways in the province of Natal by the recent floods, and of effecting certain improvements with a view to reducing the possibility of similar damage occurring in future, would be $276,250, all of which will probably be charged to capital account.

DROP TEST OF VANADIUM CAST STEEL FRAME

The photograph of the vanadium cast steel locomotive frame bent cold into the form of a semi-circle under a drop, without a sign of fracture, graphically illustrates the remarkable strength and toughness of the material. It is a rear frame made by the Union Steel Casting Company, Pittsburgh, Pa., for a Pacific type locomotive for the Southern Railway and was subjected to the following treatment in the cold: The frame was first laid on supports 6 ft. apart and subjected to the following blows from a drop-ball weighing 1,400 lbs., without breaking:

1 blow at 8 ft.
3 blows at 16½ ft.
3 blows at 16 ft.
1 blow at 15 ft.
3 blows at 18 ft.

A heavier ball weighing 4,765 lbs. was then substituted and the following blows given:

5 blows at 14½ ft.
1 blow at 14 ft.
1 blow at 13 ft.

Then the frame was stood on end and subjected to three more blows with the 4,765-lb. ball falling from heights of 6, 9 and 12

Vanadium Cast Steel Locomotive Frame After Drop Test.

ft. respectively. At the end of the test, there was not the least sign of a crack or fracture of any kind in the frame.

Physical tests and chemical analysis showed the material to have the following properties and composition:

PHYSICAL PROPERTIES

Elastic limit, lbs. per sq. in.	47,500
Tensile strength, lbs. per sq. in.	80,000
Elongation in 2 ins.	24 per cent.
Reduction of area	39 per cent.

CHEMICAL COMPOSITION

Carbon	.26 per cent	Vanadium	.203 per cent
Manganese	.516 per cent	Phosphorus	.035 per cent
Silicon	.26 per cent	Sulphur	.028 per cent

ELEVATED RAILROAD FOR CALIFORNIA.—An elevated railroad is being built in California at the Oakland terminal of the Southern Pacific—the only elevated railroad west of Chicago. The elevated line will be a double track structure with ballasted floor, 12 blocks (3,844 ft.) long, and will accommodate the suburban electric passenger trains.

NEWS DEPARTMENT

The Governor of Massachusetts has vetoed the bill passed by the legislature, permitting the New York, New Haven & Hartford to acquire all the electric railways in that state west of Worcester.

The anti-noise campaign in Chicago is receiving the co-operation of the railways, several of which have promised their assistance by eliminating some of the whistling of locomotives and the ringing of bells, which the city council committee deems unnecessary.

A press despatch from Seward, Alaska, says that the rolling stock and rights of the Alaska Northern have been turned over to a committee of business men to be operated for the benefit of the community. This action was taken by Chief Engineer Swanitz, because of a demand by the United States for payment of $67,000 mileage tax.

The shops of the Denver & Rio Grande at Salt Lake City were mostly destroyed by fire on the night of June 18; estimated loss $200,000. The paint shop, blacksmith shop, planing mill, engine room and wheel shop were destroyed, together with 25 freight cars, 6 passenger cars and 3 cabooses. Officers of the road announce that the shops will be replaced by much larger ones, but the exact location has not yet been announced.

The monorail line, extending from Bartow station on the New York, New Haven & Hartford, New York City, to Belden's Point, about two miles, has been abandoned. The company operating it, which is controlled by the Interborough Rapid Transit Company, has been reorganized and a standard gage surface electric railroad will be put in operation over this route. The monorail was operated for passenger business for a considerable time, but it has not given satisfaction.

THE NEW HAVEN'S ACCIDENT RECORD

The New York, New Haven & Hartford, because of what it characterizes as the many erroneous statements and false reports placed before the public in the Brandeis campaign, which has been almost continuous now for six years, and which finds its opportunity in accidents as well as labor and political agitation, has issued an abstract of its record of passenger train accidents for ten years from June 30, 1903, to June 15, 1913. In that time the company ran 5,078,750 trains a distance aggregating 158,531,541 miles, and in these trains carried 755,678,338 passengers paying fare. In these ten years there were 6 accidents to trains in which persons traveling on them were killed, and the number of passengers killed was 29.

In six of these ten years not a single passenger was killed in a train accident. To correct the many erroneous statements that have appeared in print, the figures by years are here given:

Years.	Passengers carried.	Train accidents in which passengers were killed.	Passengers killed in train accidents.
1903 (Last six months)	34,090,448	0	0
1904	63,234,687	0	0
1905	66,507,138	0	0
1906	72,521,069	0	0
1907	75,453,778	0	0
1908	74,382,023	1	1
1909	79,849,297	0	0
1910	83,860,031	0	0
1911	83,768,348	2	12
1912	85,350,409	2	10
1913 (to June 15)	36,661,110	1	6
Total	755,678,338	6	29

The statement continues: "In the five accidents preceding 1913 no coroner's verdict or investigation by state or national authorities found any defect in the construction of roadbed, the condition of motive power, or equipment, or in condition or operation of signals. It is because of this record for safety and because of the superior roadbed and equipment that the public is shocked over every accident, of any character, from any cause, that takes place on this road."

ENGINEERS WANTED FOR VALUATION WORK

The United States Civil Service Commission, Washington, has issued its announcements of examinations to be held for filling positions in the Interstate Commerce Commission under the act providing for the valuation of the property of railroads. The examinations will be held July 23, at the usual places in different parts of the country, and the places to be filled are as follows:

Senior structural draftsman ....Salary	$1,800 to $4,000
Senior mechanical engineer	1,800 to 4,800
Senior railway signal engineer	1,800 to 4,800
Senior electrical engineer	1,800 to 4,800
Senior inspector of car equipment	1,800 to 3,600
Senior civil engineer	1,800 to 4,800
Senior inspector of motive power	1,800 to 3,600
Senior architect	1,800 to 4,800
Architect	1,080 to 1,500
Inspector of motive power	1,200 to 1,500
Civil engineer	720 to 1,500
Inspector of car equipment	1,200 to 1,500
Electrical engineer	1,080 to 1,500
Railway signal engineer	1,080 to 1,500
Mechanical engineer	1,080 to 1,500
Structural engineer	1,080 to 1,500

In the case of positions for which the salaries are $1,800 or more the applicants are not required to assemble at any place for examination, but are rated according to the documentary evidence presented.

Persons desiring to enter an examination should at once apply for blank form 2039 to the United States Civil Service Commission at Washington, D. C.; or to the secretary of the Board of Examiners, at Boston, Philadelphia, Atlanta, Cincinnati, Chicago, St. Paul, Seattle, San Francisco, New York, New Orleans, Honolulu, St. Louis, or to the chairman of the Porto Rican Civil Service Commission, San Juan.

RAILWAY TERMINAL DISCUSSION IN CHICAGO

New plans for the solution of the terminal problem in Chicago continue to be presented to the committee on terminals of the city council. The latest is that of William Drummond, of the architectural firm of Guenzel & Drummond, who suggests a main trunk line at Englewood to be used by all through traffic entering from the south, and a three-sided loop with connections to handle the traffic from the west and north.

Following the Pennsylvania's recent ultimatum to the effect that unless the road's plan for a west side terminal is approved the present inadequate facilities will be continued indefinitely, the council committee has held several meetings at which the various plans were discussed by interested parties. Architect A. J. Graham presented arguments for the Pennsylvania plan, and F. O. Butler, of the J. W. Butler Paper Company—whose opinion is probably representative of that of the business men in localities embraced in the various plans—supported Mr. Graham's contentions.

On Saturday, June 14, Jarvis Hunt, sponsor of one of the plans, gave the committee of councilmen a long address.

The Chicago Association of Commerce, on June 11, addressed an open letter to the mayor, the city council and the citizens of Chicago urging delay in passing the proposed smoke abatement and electrification ordinance which would demand electrification of all railroad terminals by June, 1915, and which has received the recommendation of the council committee on terminals. The association denies vigorously the accusation that it

has attempted to thwart electrification or smoke abatement in the city, and says that its report, which has been in course of preparation for three years, will be ready in 1914, and will come nearer the desired solution of the problem than any haphazard action which may be taken by the council without a comprehensive investigation.

At a recent meeting of the Council Committee, Robert C. Sattley, valuation engineer for the Rock Island Lines, presented a scheme for a union station to include all the railways entering the city, even the Illinois Central, and to be located west of the river at a distance from the loop district not much greater than the new North Western terminal. Mr. Sattley's plan is the one that was originally presented in 1901 before the Western Society of Engineers and published in proceedings of that organization, but with revisions to bring it up to date.

SUBSTITUTE FOR THE CAR REPAIRER'S BLUE FLAG

The Railway Commissioners of Canada, following an investigation of certain complaints, have recommended to the railways of the Dominion that a metal or wooden disc be used as a signal for the protection of cars which are being repaired instead of the flag, "which is subject to the caprices of the wind." The commissioners recommend the use of a disc the shape of a semaphore arm to be hung on the ladder at the end of a car and so fixed as to project 18 in. beyond the side of the car. In this position it would be visible the length of an ordinary train. The horizontal arm would be fastened to a vertical board fitted with hooks by which it could be supported on the rounds of the ladder. At night a blue lantern could be hung from the projecting arm. The railways are requested to send to the commission their views on this suggestion.

THE VIEWS OF PRESIDENT REA ON THE SITUATION

I can take no gloomy view of this great country and its possibilities, notwithstanding the present unfavorable outlook. I have unbounded confidence in the business men of this country that nothing approaching confiscation or unfair dealing to lower the standards of service will ultimately be permitted, provided the railroads themselves will put their cases in the hands of the business public and clearly emphasize their needs; it is for that purpose that we are in conference with you.

So far as the Pennsylvania Railroad itself is concerned, and stripping it of all obligations connected with the lines in its system which act as feeders, it perhaps cannot be said that at present it absolutely needs an increase in transportation rates for the ordinary maintenance of its property, the payment of its present fixed charges on the outstanding capital, or to maintain the present rate of dividend.

This is the result of the conservative management I have already alluded to, which has conserved its capital account and applied all above a fair dividend to the betterment of the property; but the company itself cannot ignore the other companies in its system upon which it relies to be fed with traffic, and upon their investment and its own, as above stated, it received the low return of 4.83 per cent. in 1912.

One railroad, as you know, cannot be favored in this wise and the others excluded. If the position of the Pennsylvania system, as above stated, leaves it in need of the moderate advance in freight rates now requested, it is clear that such an advance is urgently needed on sound business reasons, by all other railroad companies, not to pay for inefficient management or undue capitalization of the past, but after exercising the best ability and foresight that can be obtained in the administration of the property the railroads are not receiving just compensation under present rates.

Unless this reasonable treatment is accorded to the railroad companies and a fair return can be earned upon the money invested in railroad facilities, the railroads will come to a standstill because capital cannot be exacted from the public unless it is suitably rewarded. Therefore, is it not time for business men of your experience to take a hand and see that only fair-minded and impartial men are sent to legislatures and regulative bodies who will co-operate with these governmental agencies of transportation—for that is what they have become in fact, although privately owned—to the end that continued good service and facilities may be assured, necessary improvements made, protection secured for the capital already invested, and the new capital raised on a basis that shall yield a fair return to the owners of the properties.

And, furthermore, can you not also do something to guard against the unwise acts of organized labor when directed to securing what might be termed coercive and class legislation as illustrated in the extra crew laws? Railroads, like other corporations, are now generally prohibited from contributing to political parties, and rightfully, but without apologizing for what existed in the past, I do believe that such contributions were made oftener for the purpose of preventing unjust legislation than to influence legislation favorable to the railroad companies.

What, however, is the difference in morals between railroads currying favor with political parties through contributions to the party purse, and so-called labor committees sitting in almost every capital and in many cases, as we are informed, promising votes in return for such unnecessary legislation as the extra crew laws? I say there is no difference, and such action should also be prohibited, and you business men can do much in this direction, if you believe the railroad position just and will make your power effective.

Such action will also be in the most enlightened interest of the employees, and encourage those who intrust their capital to us. We must all work and advance together on a mutually fair basis if we desire our country to progress.—*From an address before the Shippers of Boston, June* 12, 1913.

MEETINGS AND CONVENTIONS

American Railway Tool Foremen's Association.—The fourth annual convention will be held at the Hotel Sherman, Chicago, July 22, 23 and 24. All foremen in charge of the tool departments of machine and electric railway shops are eligible and all railway foremen are invited to the convention whether members or not. There will be elaborate exhibitions of tools and machinery in the exhibition hall adjoining the convention room, in charge of A. H. Ackerman.

It is expected that there will be a number of the higher railway officers present as speakers, and the program is as follows: 1. Reclaiming of Scrap Tool Steel; J. J. Sheehan, chairman. 2. Making of Thread Cutting Dies; A. W. Meitz, chairman. 3. Making of Forging Machine Dies; B. Hendrickson, chairman. 4. The Electric Furnace for Tempering Tool Steel; Method of Operation, Cost of Maintenance and Results Obtained; C. A. Schaffer, chairman. 5. Superheater Tools and Their Care; H. Otto, chairman. 6. The Form of Thread and Degree of Taper for Boiler Studs and Plugs; A. M. Roberts, chairman.

New England Railroad Club.—The paper presented at the April meeting was on "Modern Air Brake Equipment as Applied to Steam Roads," by Charles U. Joy, general air brake inspector, New York, New Haven & Hartford. It briefly described the air brake equipment that was in use a few years ago, discussed the changes in conditions that made improvements necessary and briefly covered the essential points of the present equipment. The paper made no mention of the electro-pneumatic brake and but briefly touched on the subject of clasp brake. The discussion was active and very largely in the nature of additional information on the successful performance of the modern equipment. Mr. Joy stated that there had been a very large reduction in the number of slid-flat wheels since the application of the P C brake to passenger cars. On the New Haven system from December, 1911, to February, 1912, there were but 77 pairs of

slid-flat wheels removed and over 50 per cent. of these were removed from cars using 70 lbs. pressure. The records show that during that period there was on an average of one pair of slid-flat wheels removed for 326,530 passenger car miles.

International Engineering Congress, 1915.—In connection with the Panama-Pacific International Exposition which will be held in San Francisco in 1915, there will be an International Engineering Congress, in which engineers throughout the world will be invited to participate. The congress is to be conducted under the auspices of the following five national engineering societies: American Society of Civil Engineers, American Institute of Mining Engineers, The American Society of Mechanical Engineers, American Institute of Electrical Engineers, and The Society of Naval Architects and Marine Engineers. These societies, acting in co-operation, have appointed a permanent committee of management, consisting of the presidents and secretaries of each of these societies, and eighteen members resident in San Francisco.

International Railway General Foremen's Association.—Indications are that the ninth annual convention, which will be held in Chicago, July 15-18, will be the most successful in the history of the organization. Greater interest is being manifested this year than at any previous time, applications are coming in in a very gratifying manner, and from roads not previously represented. This is due largely to the hearty co-operation of the superintendents of motive power, who are encouraging their general foremen to become members of the association. A number of application blanks were sent to the superintendents of motive power of every important road in the United States and Canada, who have placed them in the hands of the foremen, and in several cases repeat orders have been received.

The following is the program for the convention: July 15, 10 a. m., opening prayer by Rev. E. C. Armstrong, Chicago; address of welcome, Hon. Carter H. Harrison, mayor of Chicago; response, W. W. Scott; address, President F. C. Pickard; report of secretary-treasurer.

July 16, 9:30 a. m., Maintenance of Superheater Locomotives, R. C. Linck, chairman; address, R. Quayle, superintendent motive power and machinery, Chicago & North Western; election of officers.

July 17, 9:30 a. m., Engine House Efficiency, W. Smith, chairman; address; Shop Schedules, L. A. North, chairman.

July 18, 9:30 a. m., Driving Box Work, Geo. H. Logan, chairman; address; The Apprentice Question, F. W. Thomas.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting of mechanical associations.

Air Brake Association.—F. M. Nellis, 53 State St., Boston, Mass.

American Railway Master Mechanics' Assoc.—J. W. Taylor, Old Colony building, Chicago.

American Railway Tool Foremen's Association.—A. R. Davis, Central of Georgia, Macon, Ga. Convention, July 22-24, 1913, Chicago, Ill.

American Society for Testing Materials.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Annual meeting, December 3-6, Engineering Societies' Building, New York Railroad session, Thursday morning, December 5.

Car Foremen's Association of Chicago.—Aaron Kline, 841 North Fiftieth Court, Chicago; 2d Monday in month, Chicago.

International Railway Fuel Association.—C. G. Hall, 922 McCormick building, Chicago.

International Railway General Foremen's Association.—William Hall, 829 W. Broadway, Winona, Minn. Convention, July 15-18, 1913, Chicago, Ill.

International Railroad Master Blacksmiths' Association.—A. L. Woodworth, Lima, Ohio. Convention, August 18, 1913. Richmond, Va.

Master Boiler Makers' Association.—Harry D. Vought, 95 Liberty St., New York.

Master Car Builders' Association.—J. W. Taylor, Old Colony building, Chicago.

Master Car and Locomotive Painters' Assoc. of U. S. and Canada.—A P. Dane, B. & M., Reading, Mass. Convention, Sept. 9-12, 1913, Ottawa, Can.

Railway Storekeepers' Association.—J. P. Murphy, Box C, Collinwood, Ohio.

East Buffalo, N. Y. Convention, August 12-15, 1913, Hotel Sherman,

Traveling Engineers' Association.—W. O. Thompson, N. Y. C. & H. R., Chicago, Ill.

Personals

It is our desire to make these columns cover as completely as possible all the changes that take place in the mechanical departments of the railways of this country, and we shall greatly appreciate any assistance that our readers may give us in helping to bring this about.

GENERAL

M. K. Barnum has been appointed general mechanical inspector of the Baltimore & Ohio, with headquarters at Baltimore, Md.

Edwin G. Chenoweth has been appointed mechanical engineer in charge of car design of the Rock Island Lines, with headquarters at Chicago. Mr. Chenoweth was born December 18, 1873, at Union City, Ind. He was graduated from Purdue University in 1895, and entered the service of the Erie as a special apprentice, serving later as a machinist. During this time he took a post graduate course at Purdue University and later was air brake instructor and foreman of the air brake department of the Erie at Huntington, Ind. In 1901 he went to the Pennsylvania as draftsman and later held similar positions with the Pere Marquette, Lake Shore & Michigan Southern and the Philadelphia & Reading. He returned to the Erie in 1906 as mechanical engineer, with office at Meadville, Pa., and was appointed assistant superintendent of the car department of the Rock Island Lines in July, 1912, which position he held at the time of his recent appointment.

Edwin G. Chenoweth.

George S. Goodwin has been appointed mechanical engineer of the Rock Island Lines, in charge of locomotive design, with headquarters at Chicago. Mr. Goodwin was born November 29, 1876, at Corinth, Me., and was graduated from Cornell University in mechanical engineering in 1899, having spent his summers in railway shop work and specialized in railway engineering during the final year. In June, 1899, he entered the service of the Chicago, Milwaukee & St. Paul, as a special apprentice at West Milwaukee, Wis., and was later engaged in special test work, etc. He had charge of the company's dynamometer car while engaged in test work, both on the Chicago, Milwaukee & St. Paul and other roads. In May, 1904, he entered the mechanical engineer's office of the Great Northern, at St. Paul, Minn., where he was engaged in work connected with the standardization of locomotive and car details, and also the design of new equipment. In January, 1906, he was appointed chief draftsman of the Chicago, Rock Island & Pacific, at Chicago, and was appointed assistant mechanical engineer at Silvis, Ill., in May, 1910, which position he held at the time of his recent appointment as mechanical engineer.

F. T. Hyndman has been appointed superintendent of motive power and cars of the Wheeling & Lake Erie, with headquarters at Cleveland, Ohio.

G. W. Lillie has been appointed assistant mechanical engineer of the Rock Island Lines at Silvis, Ill., succeeding G. S. Goodwin, promoted.

D. A. MacMillan has been appointed assistant general air brake inspector of the Northern Pacific, with headquarters at St. Paul, Minn., succeeding J. M. Boyd, promoted.

William M. Mitchell has been appointed fuel supervisor of the Chicago Great Western, with office at Chicago.

George S. McKee has been appointed superintendent of motive power of the San Antonio & Aransas Pass, with headquarters at San Antonio, Texas.

George Thompson, superintendent of motive power of the Denver, North Western & Pacific, with headquarters at Denver, Colo., remains in the same position with that road's successor, the Denver & Salt Lake.

John H. Tinker, acting superintendent of motive power of the Chicago & Eastern Illinois, at Danville, Ill., has been appointed superintendent of motive power and machinery, with headquarters at Danville. He was born in August, 1864, at Altoona, Pa., and received a high school education at Altoona and began railway work in July, 1881, as machinist apprentice with the Pennsylvania Railroad. He was made vise shop foreman of the Meadows shops in June, 1896, and in December of the following year was appointed roundhouse foreman at Jersey City, N. J. He again returned to the Meadows shops in December, 1898, as erecting shop foreman, and in January, 1900, was promoted to master mechanic at South Amboy, N. J. He resigned the latter position in November, 1902, to go to the Baltimore & Ohio as master mechanic of the Chicago division, leaving in November, 1903, to become connected with the Model Gas Engine Works as machine foreman. In May, 1904, Mr. Tinker went to the Illinois Central as general foreman at Mounds, Ill., and in May, 1906, left that road to accept the position of assistant master mechanic of the Louisville & Nashville at South Louisville, Ky. Four months later he returned to the Illinois Central as master mechanic at Danville, Ill., and on February 1 of this year he was appointed acting superintendent of motive power. He now becomes superintendent of motive power and machinery, as above noted.

John H. Tinker.

MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

G. O. Huckett, road foreman of engines of the Chicago, Burlington & Quincy at Wymore, Neb., has been appointed master mechanic of the Sterling division of that road, with headquarters at Sterling, Colo., succeeding H. M. Barr, resigned.

CAR DEPARTMENT

Joseph Acker, general car foreman of the Rock Island Lines at Horton, Kan., has been appointed superintendent of the car department of the Chicago Terminal division, with headquarters at Blue Island, Ill.

P. H. Cosgrave has been appointed general car foreman of the Oregon Short Line, with headquarters at Salt Lake City, Utah.

G. A. Hull, chief clerk to the mechanical engineer of the Rock Island Lines, has been appointed assistant superintendent of the car department of the Chicago Terminal division, with headquarters at Blue Island, Ill.

F. H. Hanson, whose appointment as assistant master car builder of the Lake Shore division of the Lake Shore & Michigan Southern was announced in the June issue of the *Railway Age Gazette, Mechanical Edition,* commenced railway work with the Lake Shore & Michigan Southern in August, 1891, as a transfer man at Elkhart, Ind., becoming a fireman in October, 1892. In September, 1893, he was made baggageman at Elkhart, and in December, 1894, was appointed car inspector at that point, remaining in that position until March, 1903, when he was appointed night foreman, becoming general foreman at Elkhart in December, 1904. In September, 1908, he was appointed division general foreman at Collinwood, Ohio, remaining in that position until January, 1912, when he was appointed supervisor of material at Cleveland, Ohio, the position he held at the time of his recent appointment as assistant master car builder of the Lake Shore division.

F. H. Hanson.

SHOP AND ENGINE HOUSE

J. W. Acker has been appointed a gang foreman in the Cedar Rapids roundhouse of the Rock Island Lines, succeeding J. L. Braley.

Milton E. Amey, assistant night roundhouse foreman of the Chicago & North Western at East Clinton, Ill., has been appointed night roundhouse foreman at that point, succeeding M. J. DeLacey, promoted.

J. C. Bonesteel, roundhouse foreman of the St. Louis & San Francisco at Cherokee, Kan., has been transferred in the same capacity to Fort Scott, Kan.

J. A. Carney, superintendent of shops of the Chicago, Burlington & Quincy at West Burlington, Iowa, has been appointed superintendent of shops of that road at Aurora, Ill., succeeding A. Forsyth, deceased. Mr. Carney was educated at the Massachusetts Institute of Technology and his entire railway service has been with the Chicago, Burlington & Quincy. He commenced work in October, 1891, as laboratory assistant, and from December, 1894, to April, 1897, was engineer of tests. For four years he was master mechanic of the St. Louis division and in April, 1901, was appointed superintendent of the West Burlington shops, the position he held at the time of his recent appointment.

Martin J. DeLacey, night roundhouse foreman of the Chicago & North Western, at East Clinton, Ill., has been appointed assistant day roundhouse foreman at that point, succeeding M. E. Sargent, promoted.

C. A. Henry, erecting shop foreman of the Chicago, Burlington & Quincy, at Aurora, Ill., has been appointed superintendent of shops at West Burlington, Iowa, succeeding J. A. Carney.

J. R. Morton has been appointed locomotive foreman of the Grand Trunk Pacific at Melville, Sask., succeeding A. McTavish, transferred.

A. McTavish has been appointed locomotive foreman of the Grand Trunk Pacific at McBride, B. C., with temporary headquarters at Tete Jaune, B. C.

A. J. Roberts has been appointed locomotive foreman of the Grand Trunk Pacific at Redditt, Ont., succeeding J. R. Morton, transferred.

Merton E. Sargent, assistant day roundhouse foreman of the Chicago & North Western at East Clinton, Ill., has been appointed night roundhouse foreman at Clinton, Ia.

S. C. Stewart, acting machine foreman of the Rock Island Lines at Cedar Rapids, Ia., has been appointed machine foreman at that point.

F. S. Schorndorfer, general foreman of the Cincinnati, Hamilton & Dayton, at Ivorydale, Ohio, has been appointed general foreman of the Baltimore & Ohio Southwestern shops at Chillicothe, Ohio, succeeding J. G. Hyson, resigned.

Edgar E. Whitebread, night roundhouse foreman of the Chicago & North Western at Clinton, Iowa, has been appointed day roundhouse foreman at East Clinton, Ill., succeeding T. A. Slattery, resigned.

PURCHASING AND STOREKEEPING

C. C. Anthony, purchasing agent of the Denver, Northwestern & Pacific, with office at Denver, Colorado, retains the same position with that road's successor, the Denver & Salt Lake.

J. H. Beggs has been appointed purchasing agent of the Chicago & Eastern Illinois, with headquarters at Chicago.

A. E. Bushnell, assistant purchasing agent of the Great Northern, has been appointed purchasing agent, with office at St. Paul, Minn.

NEW SHOPS

Kanawha & Michigan.—A contract has been let for the construction of a wood working shop, 100 ft. x 200 ft., at Hobson, Ohio. The building will be of structural steel and corrugated iron.

Yazoo & Mississippi Valley.—Work will begin at once on the construction of two roundhouses at Nonconnah, Tenn., in connection with plans that provide for later construction of car and machine shops at that point.

Railway Extension in Western Australia.—One of the most important features of the policy of the enterprising government of Western Australia is that of railway extension, by which the new settlers and producers are enabled to get their goods on the markets of the world. At the present time this policy is being pursued. There are now authorized and under construction in Western Australia nine new railways, totaling in length 631 miles. This is in addition to the Trans-Continental Railway, 1,030 miles in length, which the federal government is building to connect the famous mining center of Kalgoorlie with Port Augusta in South Australia, and thereby linking Perth, the chief center of Western Australia, with all the capitals of the eastern states. One of the lines under construction by the state government, that from Wickepin to Merridin, is a part of the new state railway which is to connect with the Transcontinental Railway at Kalgoorlie. Another important line is that from Wengan Hills to Mullewa, which traverses 83 miles of country, much of it admirably suited for wheat growing; it connects the Murchison Railway with the Eastern Goldfields Railway. The other lines under construction are being taken into new agricultural districts with the object of promoting settlement and development.

SUPPLY TRADE NOTES

G. Haven Peabody has been appointed a western representative of the Lima Locomotive Corporation, with headquarters at 520 McCormick building, Chicago.

The Star Brass Manufacturing Company, Boston, Mass., has opened an office at 6 East Lake street, Chicago, in charge of Arthur F. Mundy, western representative.

John U. Higinbotham, formerly assistant treasurer of the National Biscuit Company, has been appointed assistant treasurer of the Detroit Lubricator Company, Detroit, Mich.

The Baldwin Locomotive Works has awarded a contract to the H. A. Strauss Company, Chicago, for the heavy concrete construction work on the new locomotive plant at East Chicago, Ind.

J. G. Bower has resigned as sales manager of the Hale & Kilburn Company, at Chicago, to become manager of the New York office of the Buckeye Steel Castings Company, Columbus, Ohio.

W. E. Jenkinson has been apopinted railroad representative for S. F. Bowser & Co., Incorporated, covering the territory vacated by E. F. G. Meisinger, and in addition, the southwestern and Pacific coast territory.

A. C. Moore, general manager of the Safety Car Heating & Lighting Company, New York, has been made vice-president of that company, with office in Chicago. He will have entire charge of the western business of the company.

Judge Snediker, on June 23, appointed Charles L. Harrison receiver and H. M. Estabrook co-receiver for the Barney & Smith Car Company, Dayton, Ohio. Mr. Estabrook is president of the company. The receivers were appointed on the application of Joseph Brothers & Co., Cincinnati, Ohio, creditors to the extent of $11,139. E. F. Platt, a stockholder of the Barney & Smith company, gave out a statement that the company was perfectly solvent and that the trouble had been caused by the recent floods.

The Canadian General Electric Company, Ltd., which owns and controls as subsidiary companies the Canada Foundry Company, Ltd., and the Canadian Allis-Chalmers, has decided to consolidate the selling organizations of the two latter companies, dropping the name Canada Foundry Company, Ltd., and conducting the selling organizations of both companies under the name of Canadian Allis-Chalmers, Ltd. Hereafter all sales of electrical apparatus and supplies will be in the name of the Canadian General Electric Company, Ltd., and all general engineering contracts and sales of mechanical appliances in the name of Canadian Allis-Chalmers, Ltd.

John L. Nicholson has been elected director, vice-president and general sales manager of the Locomotive Arch Brick Company, with headquarters at 1201 Chamber of Commerce building, Chicago. Mr. Nicholson was connected with the Chicago & North Western for 13 years as fireman, engineer and roadforeman of engines. He entered the employ of the American Locomotive Equipment Company in 1904, after that company had purchased the Wade-Nicholson Hall Arch, of which he was one of the inventors, and he has had a great deal of experience in the development of the brick arch to its present state of efficiency. When the American Arch Company was formed and took over the business of the American Locomotive Equipment Company, he was appointed southern sales manager, which position he held to May 1, this year.

C. A. Coffin has resigned his position as president of the General Electric Company, Schenectady, N. Y., and has been made chairman of the board of directors. Edwin Wilbur Rice, Jr.,

senior vice-president and a director of the company, has been made president, succeeding Mr. Coffin. Mr. Coffin was one of a group, who, in 1882, bought control of the American Electric Company, New Britain, Conn., which had been founded in 1880 by Professor Elihu Thomson. This company made arc-lighting apparatus under the Thomson-Houston patents. The plant was moved to Lynn, Mass., and the name of the company was changed to the Thomson-Houston Company. The company grew rapidly under the administration of Mr. Coffin. In 1892, the Thomson-Houston Company was consolidated with the Edison General Electric Company under the name of the General Electric Company, with Mr. Coffin as president. It was he who brought about the agreement between the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., and the General Electric Company in regard to the exchange of licenses under their respective patents, by which a long struggle over patents was avoided and large sums of money saved. Mr. Coffin foresaw that a large amount of capital would be necessary for the growth and expansion of electrical undertakings and was largely responsible for the education of investors to a correct appreciation of the value of securities of electrical enterprises. For this reason the present development of electrical public utilities is largely due to the efforts of Mr. Coffin.

E. W. Rice, Jr., who has just been elected president of the General Electric Company, Schenectady, N. Y., as mentioned above, was born at La Crosse, Wis., May 6, 1862. After graduating from the Central High School of Philadephia Mr. Rice became associated with Professor Thomson as assistant and confidant in the American Electric Company, New Britain. When this company was moved to Lynn in 1882, Mr. Rice went with it. In 1884 he was made superintendent and soon after technical director in charge of manufacturing. Shortly after the organization of the General Electric Company Mr. Rice was promoted to the position of chief engineer of that company. He was made third vice-president in 1896, having charge of the technical and manufacturing departments. In 1903 he was made a director and subsequently became senior vice-president of the company. Over one hundred patents have been issued in his name. Mr. Rice was instrumental in the development of high tension apparatus, the successful transmission of power at extra high voltages, and did much to improve the design of the rotary convertor and the revolving field generator, as well as electric traction equipment. Mr. Rice is a member of the American Institute of Electrical Engineers, the Institute of Civil Engineers, the Institution of Electrical Engineers of Great Britain, and a member of the Engineers' Club of New York. After the Paris exposition in 1900 he was created Chevalier of the Legion of Honor. In 1903 the degree of A. M. was conferred on him by Harvard University, and in 1906 he was given the degree of D.Sc. by Union College, Schenectady.

E. W. Rice, Jr.

RUSSIA'S PURCHASE OF RAILWAYS.—The Budget Committee of the Duma has agreed to the early purchase of the Moscow-Kasan Railway, and has expressed a wish that a bill for the purchase of the Lodz-Raisan-Ural Railway be drafted.

CATALOGS

GAS ENGINE.—A new design of horizontal, single cylinder, gas engine that is built in sizes from 10 to 30 horsepower is described in a leaflet issued by the Producers' Supply Company, Franklin, Pa.

FOUNTAIN DRAWING PEN.—The Smith fountain drawing pen is described in a leaflet prepared by Keuffel & Esser Company, New York. The ink in this pen is contained in a rubber reservoir within the handle and is fed to the blade in any desired quantity by a slight pressure of the finger on a conveniently placed lever.

WRECKING FROGS.—Fewings wrecking frogs are briefly illustrated and described in a leaflet issued by the Railway Appliances Company, Chicago. These frogs are made of open hearth cast steel, which is well annealed, and are formed to lines that a long service has shown to be satisfactory for rerailing cars and locomotives under difficult conditions.

TOBIN BRONZE.—When a material is desired that combines great strength with ability to resist corrosion and rusting, Tobin bronze has many advantages. Some of the purposes for which it can be used to good advantage and tables showing the physical and chemical properties of the material are given in a booklet being issued by the American Brass Company, Ansonia, Conn.

BRUSHES FOR DYNAMOS AND MOTORS.—Joseph Dixon Crucible Company, Jersey City, N. J., is issuing a booklet devoted to a discussion of the advantages of graphite brushes for dynamos and motors. These brushes are composed almost entirely of a high grade graphite, and have the advantage that they do not require lubrication, nor do they gum up the commutator. The booklet includes a price list.

LUBRICATORS.—A 56-page, fully illustrated catalog, issued by the Detroit Lubricator Company, Detroit, Mich., is devoted exclusively to the Bullseye locomotive lubricators and other locomotive specialties. The subject is presented in an interesting and complete manner and the different designs and sizes of lubricators manufactured by this company are fully illustrated and described. The latest developments in locomotive lubricator practice are discussed.

INDUSTRIAL LIGHTING.—The first twenty-five pages of Bulletin No. 47 from the Cooper-Hewitt Electric Company, Hoboken, N. J., are devoted to a comprehensive survey of the basic facts concerning artificial lighting and its application to industrial illumination. This treatise is well illustrated and consists quite largely of extracts from the works of recognized authorities on the subject. In the last chapter the advantages of the Cooper-Hewitt lamp for this purpose are discussed.

STEEL ARMORED HOSE.—Catalog No. 521 of the Sprague Electric Works of the General Electric Company, New York, is devoted to the Sprague flexible steel-armored hose for railroad service. Its advantages for air brake hose are given particular attention. The same material has decided advantages for use as a tank or a tender hose and for a washout or blower hose in the roundhouse. The catalog includes a full description of the methods of manufacture and the application of the armor.

BOILER MAKERS' TOOLS.—Several types of hand operated and power driven roller expanders, sectional expanders, and flue cutting machines for either boiler tubes or flues are described in the latest catalog from the J. Faessler Manufacturing Company, Moberly, Mo. This company has made a specialty of tools of this kind for the past thirty years and has developed designs of decided merit. One of the features of this catalog is the description of a safety sectional expander with a quick acting knockout.

FUEL COSTS.—An interesting discussion of the comparative cost of burning fuel oil, producer gas, natural gas and powdered coal in furnaces is included in a leaflet issued by Tate, Jones & Com-

pany, Pittsburgh, Pa. The items considered in this comparison are the cost of the fuel, cost of plant, cost of erection, floor space required, interest on investment, taxes, depreciation and repairs, labor needed to operate, power needed, cost of water and reliability. Each is considered at some length and for different sizes of plants.

Pneumatic Drill.—Some slight improvements have recently been made in the "Little Giant," pneumatic drill manufactured by the Chicago Pneumatic Tool Company, Chicago. The improved machines are very fully illustrated in bulletin No. 127 now being issued by that company. In the forty pages of this bulletin is shown a complete line of pneumatic drills for either metal or wood working. Many of them are reversible. Tables are given showing the general dimensions, speed, air consumption and capacity of each different design illustrated.

Effect of Soot.—While it is generally understood that a coating of soot considerably reduces the evaporative qualities of a boiler, it is doubtful if it is fully appreciated that a coating 1/16 in. thick will decrease the heat conductivity of a boiler plate over 26 per cent. The amount of loss due to various thicknesses of soot coating, together with a full discussion of the whole subject in all its phases, is contained in a paper by Dr. S. J. Herman, which is being reprinted and issued by the Diamond Specialty Company, 80 First street, Detroit, Mich.

Curtain Window Ventilator.—A device for closing the opening at the bottom of an open window in passenger or sleeping cars is described in a leaflet being issued by the Gold Car Heating & Lighting Company, New York. It consists of a narrow heavy curtain mounted on a spring roller inclosed in a metal case. This case is secured in a vertical position at one side of the window frame at the bottom and the curtain is drawn across and hooked on a peg at the opposite side, closing the opening at the bottom from direct drafts but allowing the air to pass up behind it. It is also suited for use in offices and dwelling houses.

Economy Uncoupling Device.—Spencer Otis Company, Chicago, Ill., is issuing a leaflet illustrating and describing the Economy uncoupling device which consists of the fewest possible number of parts for a satisfactory uncoupling arrangement. It has a single rod in one piece and two malleable iron brackets for each end of the car. The rod is slipped through the brackets and pin before they are bolted or riveted to the car. It couples direct to the coupler lock and the effect of the movement of the coupler head is taken care of by a telescopic bracket which allows a total horizontal movement of seven inches without causing any strain on the lock.

Weather Test of Paint.—In 1906 the Pennsylvania completed a steel, double track, deck-bridge across the Susquehanna River near where it joins the Chesapeake Bay. This bridge has a length of nearly a mile and when it was ready for painting, it was recognized by certain engineers of the American Society for Testing Materials that the convenience of location offered an unusual opportunity for a time test of different formulas of metal protective paint. These tests were carried out with the utmost care and in addition to the bridge structure itself, sample steel plates were also exposed on the bridge. A booklet issued by the Lowe Brothers Company, Dayton, Ohio, fully describes these tests and includes the reports of the experts who had them in charge.

Case-Hardening and Heat-Treating.—An unusually good selection of useful information and practical rules on the case-hardening and heat-treating of steel is found in the fifth edition of a bulletin being issued by the Ideal Case-Hardening Compound Company, New York. This book discusses some of the most interesting properties of iron and steel, explains fully the theory of case-hardening operations, describes the best equipment in use; fully explains how to pack the material to be hardened, the time it should be heated, the depth of the penetration, how to reheat, anneal, etc. One of the sections is devoted to alloys and impurities and their effects on the steel. Each is discussed separately and at some length. A section is also devoted to a discussion of the best substitutes for costly alloy steels.

Water Weigher.—The Kennicott Company was recently awarded the John Scott legacy medal by the City of Philadelphia, on the recommendation of the Franklin Institute, for its water weigher or measuring device. This weigher consists of a shell, the lower part of which is divided in two measuring or weighing compartments and a tipping box composed of two halves which alternately fill with water and serve the double purpose of furnishing a sufficient quantity of water to start the siphon in the weighing compartment and to shift the supply from one compartment to the other. This tipping box is balanced on steel pivots, or knife edges, is mounted directly above the weighing compartment and is operated by floats, one in either compartment. A counter is provided for registering each double unit charge delivered by the weigher, and in this way the record is maintained. The weigher is fully illustrated and described in bulletin No. 38 from the Kennicott Company, Chicago Heights, Ill.

Mikado Locomotives.—Bulletin No. 1013 from the American Locomotive Company, New York, is devoted to a discussion of the Mikado type locomotive. The advantages of this type for freight transportation are briefly considered on the first page and a table is included giving the results of comparative service tests made on seven different railways between Mikado and consolidation type locomotives. This shows the increase in the amount of train load and the decrease in coal and water consumption that has been made possible by the introduction of this type. A full list of dimensions of twenty-four different designs of these locomotives, built by this company for various railways, is given in the next two pages of the pamphlet. Following are illustrations of sixteen different Mikado type locomotives, each accompanied by a table showing the amount of tonnage behind the tender it is able to pull at various speeds from 5 miles to 30 miles per hour and at various grades up to one per cent. These figures are based on the maximum tractive effort at different speeds with cars of 70 tons gross lading and a frictional resistance of three pounds per ton on the level.

Railway Difficulties in Argentina.—Notwithstanding the remarkable progress which is manifested year by year by the great majority of Argentine railways, some of the troubles from which they have suffered, almost from the beginning of their successful career, have still to be faced. Among these difficulties may be included the native jealousy which exists in regard to foreign enterprises and which it would appear is most difficult to overcome. This jealousy manifests itself in particular in the relations existing between the companies and the municipalities; so acute is this at times that several important improvements had to be abandoned, and as a consequence the public suffers and the companies sustain financial losses. A case in point is the dispute which of late has raged between the Central Argentine Railway and the Cordoba municipality. It had been the wish of the company to erect a handsome station in the city of Cordoba. From the commencement, however, the company has met with scant consideration from the municipality; on the contrary, a spirit of opposition has been displayed even in regard to the most simple matters. At length the patience of the company has been exhausted and the board of directors in London, acting upon information sent to them from Cordoba, have telegraphed instructions to their local representatives in Cordoba, to suspend all work upon the new station building, to sell the materials already received and to dismiss all the workmen employed. The directors' action was precipitated by the persistent and unreasonable difficulties placed in the way of progress by the municipality, especially in regard to the matter of approaches to the new station building. While the interests of the company are bound to suffer by this drastic decision, those of the traveling public will be more seriously affected still.